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CITATION:

Chiji, Manzo ...[et al]. REGIONAL FORAMINIFERAL ASSEMBLAGES IN TANABE BAY, KII PENINSULA, CENTRAL JAPAN. PUBLICATIONS OF THE SETO MARINE BIOLOGICAL LABORATORY 1968, 16(2): 85-125

ISSUE DATE:

1968-09-25

URL:

<http://hdl.handle.net/2433/175540>

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REGIONAL FORAMINIFERAL ASSEMBLAGES IN TANABE BAY, KII PENINSULA, CENTRAL JAPAN¹⁾

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With Plates VI-XV and 8 Text-figures

Introduction

The fauna of Tanabe Bay is as well known as its oceanography and submarine geology, for Tanabe Bay has long been the home of the Seto Marine Biological Laboratory of the University of Kyôto. Foraminiferal assemblages and their distribution in the bay, however, have not been studied extensively until this time.

Knowledge of foraminiferal assemblages in various environments and the distribution of the living and non-living faunas with known oceanographic factors should prove invaluable to the study of the marine ecology of the Bay. Furthermore, this knowledge is expected to contribute some new information to the paleontological or paleophysical condition of sedimentation of the Pleistocene marine terrace deposits and also of the alluvium distributed along the coast of the Japanese Islands.

In this work, 14 sediment samples selected from the material collected at 33 stations in Tanabe Bay by the present writers in April, 1966 were studied to describe the foraminiferal assemblages and their distribution in Tanabe Bay and to discuss some of its ecological implications (Fig. 1). Field work was done on board a surveying boat of the Laboratory. This work was supported in part by a research grant from the Kôyosha Foundation and the Hôkoku-sekizenkai Foundation of Ôsaka.

Acknowledgements

The writers wish to thank the Seto Marine Biological Laboratory of the University of Kyôto and the Ôsaka Museum of Natural History for the use of their facilities during

1) Contributions from the Seto Marine Biological Laboratory, No. 489 and Contributions from the Ôsaka Museum of Natural History, No. 119.

various aspects of this study. Dr. Shin-ichiro FUSE of the Seto Marine Biological Laboratory performed the dissolved oxygen analysis and gave valuable help in the field work. Dr. Takasi TOKIOKA of the same laboratory kindly read the manuscript of this paper and gave much valuable suggestions to the writers. The junior writer

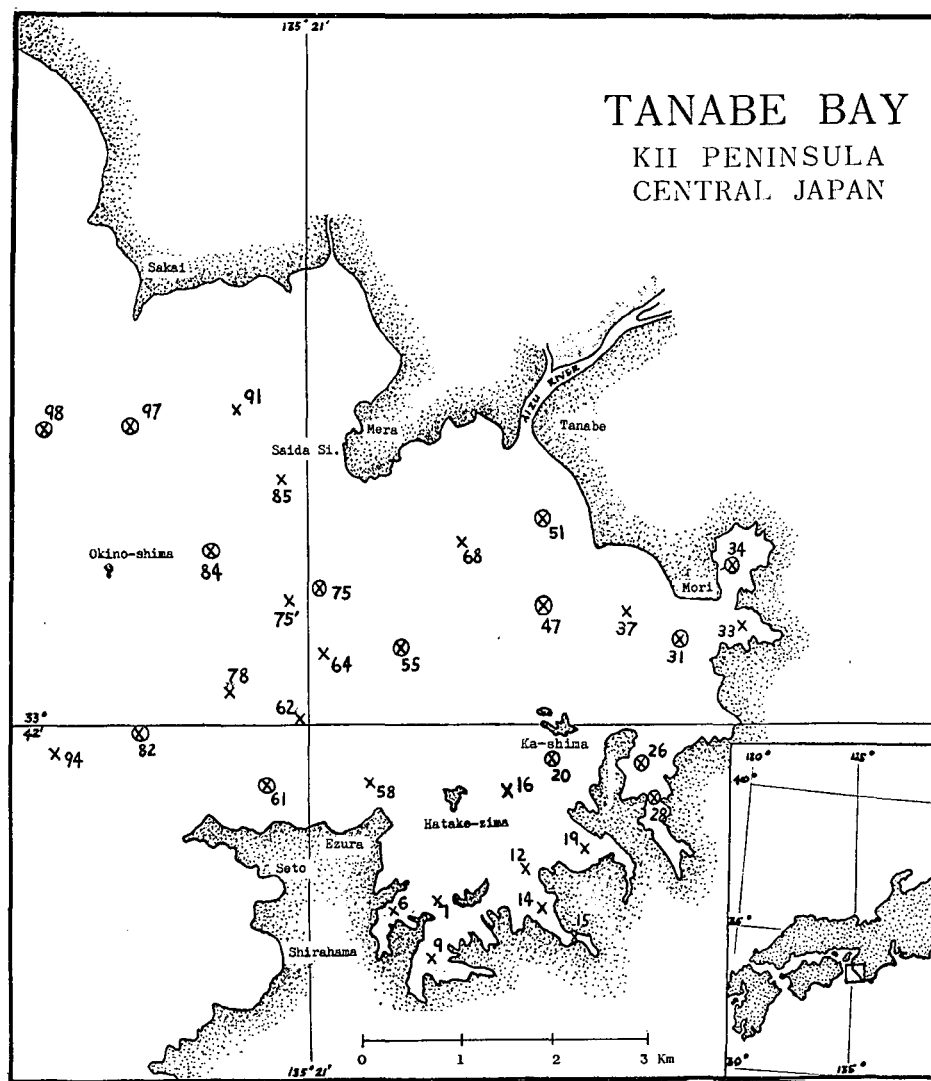


Fig. 1. Station map in Tanabe Bay; the oceanographic observations were made at all stations, while the faunal examinations were limited to those in circle.

wishes also to express his sincere gratitude to Prof. Emeritus Susumu MATSUSHITA, Prof. Keiji NAKAZAWA and Dr. Yasuo NOGAMI of the Institute of Geology and Mineralogy of the University of Kyôto.

Method of study

The samples were collected with an EKMAN-LENZ's Bottom Sampler. Formaldehyde of 3.5–4.0% was added to these to preserve living foraminifers. In addition to sediment and bottom water sampling, the bottom water temperature, chlorinity, dissolved oxygen content, and hydrogen ion concentration of the bottom water were measured at each collecting station.

For the present study 20 g of each wet sample was examined. Aliquots for examination were respectively washed through a sieve of 0.074 mm meshes and stained with rose of Bengal (WALTON, 1952; KUWANO, 1956) to determine living populations. They were rewashed using the water-bath and sieve, oven-dried, and then weighed for records. To obtain a manageable population, the aliquots thus prepared were mechanically split into some fractions. Each fraction to be studied was weighed and its size was adjusted to include 250 or so foraminiferal specimens in it. The total population in 20 g aliquot was approximated by comparing the weight of the whole fraction coarser than 0.074 mm in diameter with that of the fraction used for the actual counting.

Percentages of respective species were calculated in each sample to define the foraminiferal assemblages in various environments.

The carbon-tetrachloride separation method was not adopted in this study, because it was found that in some cases, some of the forms could not be afloat for their thick wall or breakage, or for other reasons.

Depository of materials

All the figured specimens are deposited in the Ōsaka Museum of Natural History under the registered numbers F10607F to F10755F inclusive.

Previous works in the area

MORISHIMA (1948, 1950) analyzed 49 samples from Ago Bay in southeastern Kii. He reported 183 species; 6 of them were planktonic and 24 were arenaceous foraminifers. He noted the gradual decrease of the number of foraminiferal tests towards the innermost section of the bay contrary to the distributions in Obama and Maizuru Bays on the Japan Sea side of Japan (MORISHIMA, 1947). He recognized the following five types of foraminiferal assemblages in that bay.

- A) *Globigerina* assemblage: at the entrance of the bay,
- B) *Amphistegina*—*Elphidium crispum* assemblage: distributed near the mouth of the bay,
- C) *Rotalia papillosa*—*Quinqueloculina lamarckiana* assemblage: occupying the central part of the bay proper,

- D) *Elphidium craticulatum*—*Textularia hauerii* assemblage: in certain sections of some coves,
E) *Trochammina* assemblage: limited to the innermost part of the bay.

UCHIO (1962) made a quantitative analysis of the foraminiferal faunas from the beach and nearshore sediments along the west coast of Kii Peninsula. He noted the predominance of *Elphidium*, Miliolidae and *Amphistegina* in the beach sand of the area and *Ammonia* in the wharf-area samples. In Tanabe Bay, he analyzed foraminiferal faunas from 4 stations, 3 of which were set in Mori Harbor. At one station in the harbor, the fauna consisted mainly of *Ammonia beccarii asanoi*, with *Elphidium* (mainly *E. subincertum*) and some arenaceous species such as *Trochammina* cf. *globigeriniformis*, *Textularia earlandi*, etc. Off the harbor, the percentage of *Ammonia* in population dropped significantly, while some species of Elphidiidae and Miliolidae, such as *E. incertum*, *E. advena*, *Miliolinella circularis*, etc., increased in percentage.

FUSE, YAMAZI and HARADA (1958), FUSE (1959), and FUSE and HARADA (1960) published several papers on the oceanographic conditions of Tanabe Bay; MII (1962) studied its submarine geology.

Submarine geology

The average declivity of the sea bottom off the southwestern coast of Kii Peninsula is 12 m/km. Three submarine canyons, interpreted by TOYAMA as drowned land rivers, traverse the continental slope and the outer margin of the shelf, each starting as a narrow gorge and running south straight down to the depth of about 1,500 m and branching in a dendroid pattern.

MI (1962) divided the submarine area of Tanabe Bay topographically into four submarine terraces. The first terrace or the offshore platform, ranging from 0 to 10 m below the lowest water level, occurs on the sea bottom adjacent to the promontories, islands or reefs. Its landward margin is usually backed by a steep or nearly vertical cliff which is often incised with notches, while the seaward edge to the second terrace, at the depth of 15 m, is bordered by about 5 m high steep slope often covered with sand and silt. The second terrace is distributed throughout the sea adjacent to the coast. In the open sea area, the bedrocks are usually exposed at the landward margin of this terrace. Because of such sporadic exposure of the rocks, the terrace is covered with only thin sediments. The third submarine terrace, at the depth of 25 to 35 m is also furnished with sporadic exposure of bedrocks and generally bordered with about 10 m high relatively distinct slope between it and the fourth terrace which is extending at the depth of 50 to 100 m and covered uniformly with sand and silt.

Some shelf channels, attributed by MI to drowned land valleys, are found on the floor of Tanabe Bay. They are extending in a dendroid pattern in the direction E-W or NEE-SWW. Majority of their branching channels start respectively from deep coves of the bay or from channels between islands or reefs but never extend to

the deep submarine canyons starting from the shelf break. The bay sediment in most part is the fine-grained mud falling into the silt and clay size range, though in some areas, especially around the entrance to the bay where the tidal current to the northwest is rather significant, the floor is sandy with numerous patches of gravels. In the cove of Mori, the bottom sediment is muddy with a considerable amount of organic debris. Such a distribution pattern of bottom sediments agrees with that already shown by MII (1962), (Fig. 2).

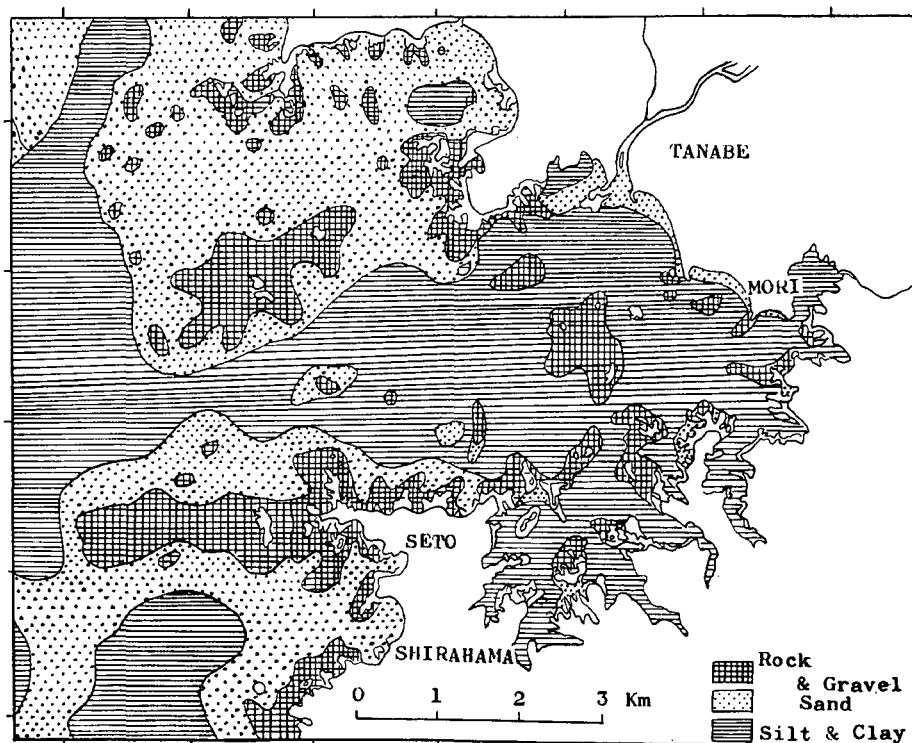


Fig. 2. Bottom sediments of Tanabe Bay (after MII, 1962).

Hydrographical outline of the Bay

The warm current, Kuroshio, flows northeast off the southern tip of Kii Peninsula with an average speed of about 7 km/hr at surface. The current off Tanabe Bay is not maintained uniformly, but most frequently affected by a minor branch of the Kuroshio flowing northwest. And in Tanabe Bay the influx of the oceanic water reaches usually southeast the area between the two islets, Kashima and Hatakezima. Waves and surf are prominent along the coast in the western half of the Bay and swells which are most remarkable during the stormy season from July to September approach the Bay from the south. The water is much agitated by the monsoon from

the northwest from late autumn to early spring.

The mean high water level is 0.6 m and the highest water level is 1.2 m above and the mean low water level is 0.5 m and the lowest water level is 1.3 m below the mean sea level (MII, 1962).

The distribution of the bottom water temperature (Table 1) showed a tendency to the increase in the northeastern part of the bay exclusive of the cove of Mori,

Table 1. Hydrological data at sampling stations in Tanabe Bay, April 26-27, 1966.

Station No.	Depth in m	Bottom Water				Mud Temp. in °C
		Temp. in °C	O ₂ in %	pH	Chlorinity in ‰	
6	9	20.5	100	8.3	19.00	—
7	15	20.1	115	8.3	18.89	18.7
9	10	21.1	115	8.3	19.09	20.0
12	15	20.1	115	8.3	19.00	18.7
14	8	20.4	100	8.3	19.00	19.6
15	4	20.4	115	8.3	19.00	19.5
16	19	19.2	150	8.3	19.12	18.1
19	10	20.4	100	8.3	19.01	20.0
20	15	19.8	105	8.3	19.03	19.3
26	12	20.2	104	8.3	19.02	19.0
28	9	20.4	100	8.3	18.95	19.8
31	9	21.2	100	8.3	19.07	20.0
33	2.5	21.4	112	8.3	19.08	20.5
34	7	19.5	100	8.3	18.78	19.0
37	7	21.4	105	8.3	19.23	20.0
47	9	21.5	104	8.3	19.21	20.5
51	7	21.4	100	8.3	19.12	20.8
55	24	19.3	100	8.3	19.23	—
58	15	21.1	115	8.3	19.27	—
61	21	21.0	100	8.3	19.27	21.0
62	26	20.5	107	8.3	19.08	19.5
64	27	20.4	100	8.3	19.14	19.5
68	12	21.3	100	8.3	19.20	20.5
75	25	19.3	100	8.3	18.95	18.5
75'	31	19.2	102	8.2	19.04	20.0
78	31	19.2	110	8.3	19.25	19.0
82	38	19.9	? 78	8.2	19.33	20.8
84	31	19.8	106	8.2	19.08	19.4
85	23	19.8	110	8.3	19.02	—
91	18	20.8	100	8.3	19.09	—
94	40	19.8	94.2	8.2	19.26	—
97	24	20.0	100	8.3	19.30	—
98	33	20.8	110	8.3	19.25	22.0

21.37°C on an average, whereas the mean temperature was 19.85°C near and outside the mouth of the bay. The temperature was generally a little lower in coves.

The bottom sediment temperature ranged from 18.5 to 21.0°C throughout 33 stations. It was nearly equal to or slightly higher than the bottom water temperature outside the bay, the difference being 0.25°C on an average. In the bay, however, the former was a little lower than the latter, the difference being 0.89°C on an average.

The chlorinity of the bottom water ranged from 18.78 to 19.33‰ throughout 33 stations, with the mean chlorinity 19.10‰. Naturally it was higher outside the bay, 19.25 to 19.33‰ and 19.29‰ on an average, and lower in the coves of the bay, 18.78 to 19.09‰ and 18.97‰ on an average. It was noteworthy that an area of comparatively low chlorinity, 19.09‰ on an average against 19.17‰ for other parts of the bay proper, was found in the northern part near the mouth of the bay. This might be a temporary phenomenon attributable to a special hydrological condition caused by the existence of the reef extending from Saida-saki to Okinoshima and inhibiting the bottom water flowing and some tidal phase. When the salinity temperature relation is taken in consideration, it is noted that the lower temperature can be combined with both the high and low extremities of the chlorinity range: the former indicates the oceanic water mass and the latter seems to show the stagnant water mass in the inner part of the bay.

The dissolved oxygen content of the bottom water was measured by using the "JARREL-ASH Model 26-601 Dissolved Oxygen Analyser". As seen in Table 1, the dissolved oxygen seemed to be saturated all over the bay except for Stations 82 (?78%) and 94 (94.2%) outside the bay. The content was especially prominent (115%) at some stations (Sts. 7, 9, 12 and 15) near the south-east corner of the bay, which is highly sheltered, and at Station 58 which seems to be located in the course of the outflow of the stagnant water of the inner part of the bay.

The pH was uniformly 8.3 throughout the bay, except for several stations (Sts. 75', 82, 84 and 94) near and outside the bay mouth, where the pH was 8.2.

In the summer season, the water temperature attained 28.59–30.30°C at surface and 29.56°C on the bottom; and it was lower at the southwestern ocean-side stations and higher at the northeastern land-side stations (in August 1958, FUSE and HARADA, 1960). The chlorinity was 18.44–18.93‰ at surface and higher at the lower temperature stations and lower at the higher temperature stations.

In late autumn, the water temperature was 20.28–23.14°C at surface and lower near the entrance to the bay and became higher toward the southeast. The chlorinity was 14.35–18.96‰ at surface and higher by up to 0.3‰ near the bottom in the bay proper. In the cove of Mori, the surface water chlorinity was lower by 4.42‰ than the bottom water (in November 1956; FUSE, YAMAZI and HARADA, 1958).

The hydrographical condition of the spring season observed by the present writers shows some resemblance to that of the summer season when the southerly wind

is dominant. On the contrary, the condition in November 1956 is evidently affected by the influx from the northwest.

Both inorganic phosphate and silicate decreased toward the ocean side of the bay, and from the surface to bottom in November 1956 (FUSE, YAMAZI and HARADA, 1958), while they increased from the surface toward the bottom in August 1958 (FUSE and HARADA, 1960).

Thanatocoenoses

The foraminiferal fauna in Tanabe Bay shares characteristics common to other faunas in the inlets on the coast of Southwestern Japan influenced by the warm current Kuroshio; the most striking is a high population of very numerous species, especially tropical and subtropical.

In Tanabe Bay, 239 benthonic foraminifers were recognized in this work. The calcareous Miliolidae is represented most abundantly, with 13 genera of which *Quinqueloculina* is the most abundant genus with 28 species and followed by *Triloculina* with 10 species.

The Discorbidae is also rich with 10 genera; *Rosalina* is the most significant genus with 9 species.

Among the arenaceous forms, the Textulariidae is the most significant with the prominent genus *Textularia* represented by more than 13 species, and followed by the genus *Trochammina* with more than 4 species.

The larger numbers of species were found at Station 82 (114 spp.), 84 (110 spp.) and 61 (96 spp.) in the southern part of the bay mouth; while the smaller numbers of species, at Stations 34 (21 spp.), 31 (31 spp.) and 28 (39 spp.) in the innermost part or coves of the bay. In general, the number of species decreases toward the inner part of the bay exclusive of Station 20 where an exceptionally large number of species (111 spp.) was found. Probably this indicates that the station is greatly affected by the oceanic water. In the open sea area near the bay mouth, the number of species in the northern part was less than in the southern part (Table 2).

BANDY (1954) in his study of the shallow water Foraminifera in the Gulf of Mexico, and UCHIO (1960) in his ecological study of the living benthonic Foraminifera from San Diego, California arrived at the same conclusion that the number of species increases with the distance from the shore due to the more rapid sedimentation in the nearshore waters and to the fairly stable chlorinity in the offshore waters. The same tendency is suggested in Tanabe Bay, too.

The size of population of the original samples (20 g aliquot of respective wet samples) was large in the bay mouth region, especially in its southern part as in the distribution of the number of species. The least population was found at Stations 51 and 34. St. 51 is situated near the estuary of the Aizu River and St. 34 in Mori Harbor, both affected by the fresh water inflow. At these stations, some change was

Table 2. Distribution of Foraminiferal populations and species in Tanabe Bay (in 20 g aliquot).

St. No.	98	97	82	84	75	61	55
Total population	6,474	679	14,259	14,723	3,146	31,086	4,608
Living population	66	2	33	140	180	190	42
Living/Total Ratio (%)	1.02	0.29	0.23	0.95	5.72	0.61	0.91
Total species	83	42	114	110	57	96	54
Living species	3	1	1	4	6	2	2
Living/Total Ratio (%)	3.6	2.4	0.9	3.6	10.5	2.1	3.7

St. No.	51	47	20	31	28	26	34
Total population	584	6,902	7,261	911	1,190	1,799	557
Living population	57	110	104	60	190	270	138
Living/Total Ratio (%)	9.76	1.59	1.43	6.59	19.67	14.91	24.72
Total species	54	81	111	31	39	47	21
Living species	9	4	7	8	11	9	7
Living/Total Ratio (%)	16.7	6.2	6.3	25.8	28.2	19.1	33.3

recognized in composition of the foraminiferal population.

The poor population at Station 97 in the northwest part of the bay near the mouth (less than 1000 per 20 g aliquot) may be due to the special sediment composition consisting of clean, coarse shell-sand but scarcely containing organic materials available as food for benthonic organisms (SVERDRUP and others, 1942).

SAID (1951), in his study of the Foraminifera of Narragansett Bay, noted the general increase of individual number away from the open ocean. He further referred to the possibility that MORISHIMA's finding in Ago Bay (*op. cit.*) which is contrary to his, would be substantially altered if the planktonic foraminifers were not counted. In Tanabe Bay, as mentioned above, the population size of both live and dead benthonic foraminifers decreases with the distance from the open sea and the bay mouth toward the inner part of the bay, as shown in MORISHIMA's finding.

Distribution of species: Each foraminiferal species was found to have its own characteristic distributional area in the bay. Some were restricted within narrow protected area, while others were found having wider distributions. To get more detailed distributional pattern of respective species, it is necessary to do with much more sediment samples from further additional stations. However, the outline of the distribution of each studied species may be presented safely as follows (Table 3, Fig. 3).

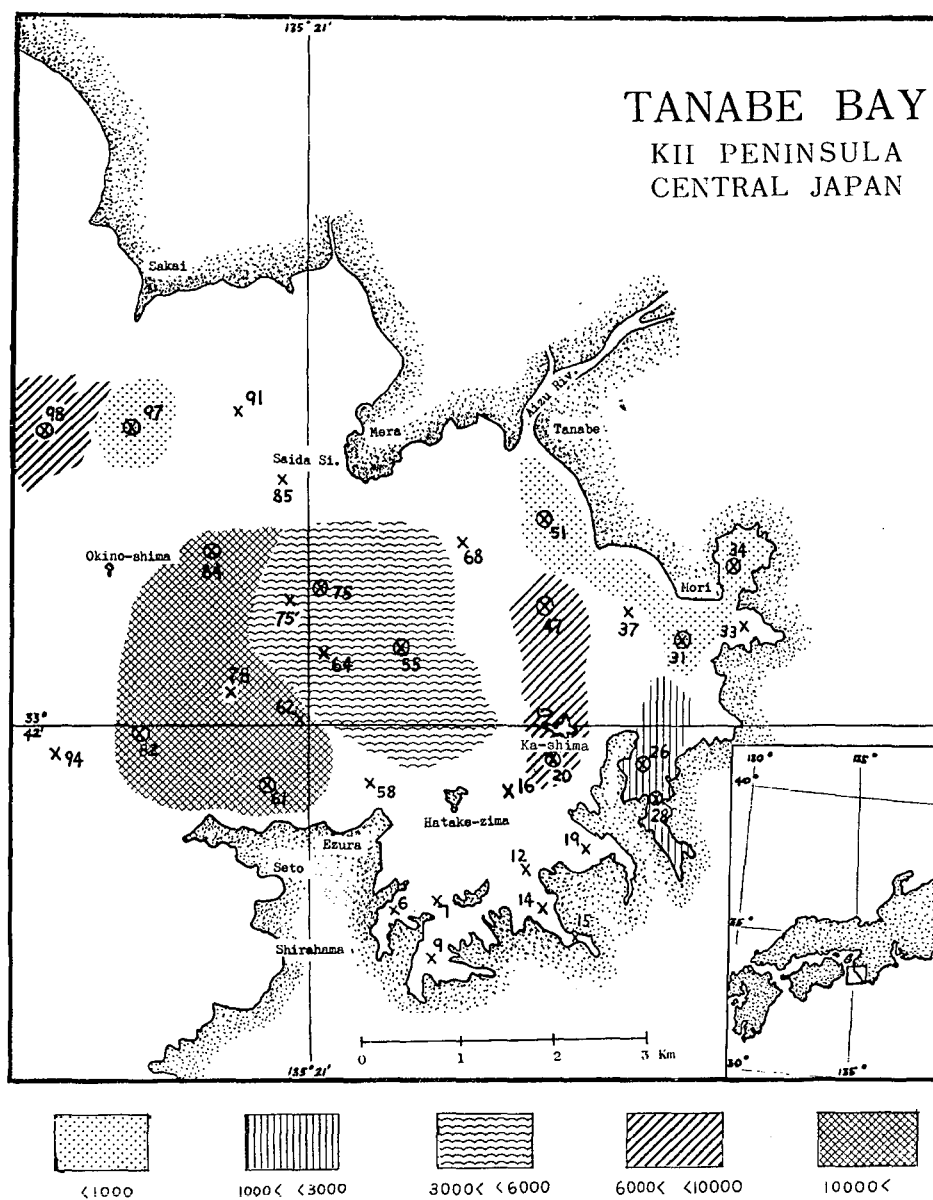


Fig. 3. Distribution of the total population of benthonic Foraminifera in Tanabe Bay (in 20 g aliquot).

- 1) The species found most widely throughout the studied area are:—*Ammonia beccarii* "forma A", *Elphidium advena*, *E. crispum*, *E. hispidulum*, *E. jenseni*, *E. matagordanum*, *Florilus grateloupi*, *Gavelinopsis* cf. *praegeri*, *Glabratella patelliformis*, *Globocassidulina subglobosa*, *Lagena striata*, *Miliolinella oblonga*, *Quinqueloculina laevigata*, *Q. seminulum*, *Rosalina floridana*, *R. globularis*, and *Trochammina globigeriniformis*. Of these species, *A. beccarii* "from A" is dominant in the coves. *T. globigeriniformis* and *Q. seminulum* are distributed uniformly all over the area. Other species are abundantly distributed near the mouth of the bay, but decreasing in number toward the inner part of the bay.
- 2) The species found widely in the bay but absent in the coves, are:—*Anomalina globulosa*, *Bolivina glutinata*, *B. robusta*, *Brizalina striatula*, *Bulimina marginata*, *Cibicides pseudoungerianus*, *Discorbis mira*, *Hanzawaia nipponica*, *Hauerina bradyi*, *H. pacifica*, *Miliolinella circularis*, *Neoconorbina terquemi*, *Planorbulina* cf. *mediterraneensis*, *Quinqueloculina bradyana*, *Q. candeiana*, *Q. granulosa*, *Q. vulgaris*, *Rosalina concinna*, *R. vilardeboana*, *Spiroloculina corrugata*, *Triloculina affinis*, etc. Most of these species are abundant in the open sea area.
- 3) The following species are found in the open sea to central part of the bay, but absent in the inner part of the bay:—*Amphistegina radiata*, *Brizalina seminuda*, *Cibicides lobatulus*, *C. refulgens*, *C. subhaidingerii*, *Glabratella australensis*, *G. opercularis*, *G. opercularis nakamurai*, *Nonionellina labradorica*, *Pyrgo denticulata*, *Quinqueloculina bicornis*, *Q. contorta*, *Q. parkeri*, *Reussella aculeata*, *Textularia candeiana*, *T. conica*, *T. secasensis*, *Uvigerina proboscidea*, *Vertebralina striata*. Among these species, *C. subhaidingerii* and *A. radiata* are dominant in the open sea, while others are rich in the bay mouth area.
- 4) The following species are restricted in the open sea to the bay mouth area:—*Amphistegina madagascariensis*, *Bolivina subangularis*, *Calcarina hispida*, *Gaudryina robusta*, *Gyroldina soldanii*, *Heterostegina glutinata*, *Operculina ammonoides*, *Poroeponides cribrorrepandus*, *Quinqueloculina agglutinata*, *Q. bicarinata*, *Q. crassa*, *Textularia articulata*, *T. pseudogramen*, *Triloculina sabangularis*, etc.
- 5) The species widely distributed in the bay but absent in the open sea area:—*Ammomarginulina foliaceus*, *Ammonia beccarii tepida*, *Cyclogyra involvens*, *Elphidium translucens*, *Florilus japonicus*, *Fursenkoina pauciloculata*, *Loxostomoides durrandii*, *L. limbatum*, *Massilina inaequalis*, *Milonis nikobarensis*, *Nonionella miocenica*, *Pararotalia* cf. *imperatoria globosa*, *P. murrayi*, *Quinqueloculina agglutinnans*, *Q. bociana*, *Sigmoilopsis schlumbergeri*, *Textularia foliacea*, *Triloculina planciana*, *T. tricarinata*, etc. Among these species, *C. involvens*, *L. durrandii*, *L. limbatum*, *M. nikobarensis*, *Q. cf. agglutinnans*, *Q. bociana*, *T. foliacea*, *T. planciana* and *T. tricarinata* are absent in the coves. *A. foliaceus* and *F. pauciloculata* are particularly abundant in the bay mouth area, and *M. inaequalis* in the central part of the bay.
- 6) The following species are limited to the bay mouth area to the central part of the bay:—*Astrononion stelligerium*, *Bolivinella folium*, *Cassidulina laevigata*, *C. cf. minuta*, *Cibicides aknerianus*, *Cymbaloporeta bradyi*, *Epistominella tamana*, *Fissurina marginata*,

Glabratella cf. *pulvinata*, *Hauerina frigidissima*, *H. orientalis*, *Pseudorotalia gaimardii*, *Quinqueloculina elongata*, *Q. lamarckiana*, *Q. sulcata*, *Triloculina oblonga*, *Wiesnerella auriculata*, etc.

7) The following species are found only in the bay mouth area:—*Discorbinella aurauca*, *Gaudryina subglabrata*, *Pattelina corrugata*, *Quinqueloculina poeyana*, etc.

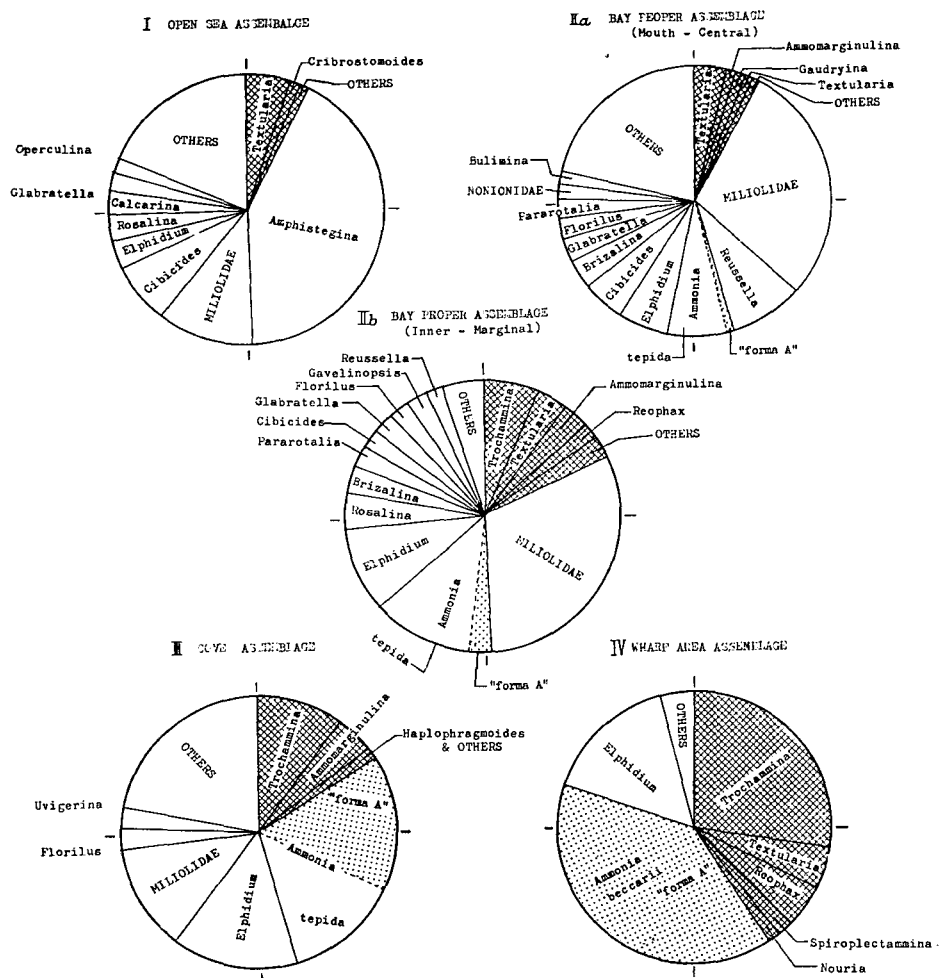


Fig. 4. Foraminiferal assemblages in Tanabe Bay.

8) The species found in the bay but absent in the open sea and the bay mouth area, are:—*Bulimina aculeata*, *Martinottiella bradyana*, *Massilina planata*, *Nourina polymorphinoides*, *Textularia crecentiformis*, *Uvigerina* cf. *carinata*, etc. Of these species, *N. polymorphinoides* and *M. bradyana* are restricted within the coves.

Assemblages: Four regional assemblages may be defined in Tanabe Bay on the

distribution and abundance of the above mentioned species. They are given in Text-fig. 4 which shows the composition of each of these four assemblages.

I. Open sea assemblage (Text-fig. 4, I)

This assemblage found at Stations 97 and 98, is characterized by the abundance of *Amphistegina* (mainly *A. madagascariensis* or *A. radiata*), accompanied by *Cibicides* (dominant species: *C. pseudoungerianus*, *C. refulgens*, *C. subhaidingerii*), *Calcarina hispida*, *Elphidium* (mainly *E. crispum*), *Glabratella* (mainly *G. opercularis* or *G. opercularis nakamurai*), *Operculina ammonoides*, and *Rosalina*.

Heterostegina glutinata, *Quinqueloculina agglutinans*, *Q. bicarinata*, *Sorites marginalis*, *Textularia articulata* are also comprised in this assemblage. The arenaceous form found in this assemblage is mainly *Textularia*.

This assemblage is seemingly comparable with the *Amphistegina lessonii* assemblage defined by УЧЮ (1962) on the beach sand sample collected at Seto of this vicinity. As he did not give any taxonomic discussion of his species, *A. lessonii*, nor its illustration, it is very unfortunately impossible at present to check our *Amphistegina* with his *A. lessonii*. We identified our forms with *A. madagascariensis* and *A. radiata* described by TODD (1965).

II. Bay proper assemblage (Text-fig. 4, IIa & IIb)

The assemblage found in the main part of the bay is characterized by the abundance of Miliolidae and a considerably high percentage of *Ammonia beccarii tepida*. *Elphidium* (dominant species: *E. matagordanum*, *E. hispidulum*, *E. advena*), *Brizalina* (dominant species: *B. seminuda*, *B. striatula*), *Cibicides* (dominant species: *C. lobatulus*, *C. pseudoungerianus*, *C. refulgens*), *Gavelinopsis* cf. *praegeri*, *Glabratella* (dominant species: *G. opercularis*, *G. opercularis nakamurai*, *G. patteliformis*), *Florilus* (mainly *F. japonicus*), *Pararotalia murrayi*, *Quinqueloculina* (dominant species: *Q. bradyana*, *Q. laevigata*, *Q. granulosum*, *Q. vulgaris*), *Reussella aculeata*, and *Rosalina* (mainly *R. floridana* and *R. globularis*) are important calcareous members of this assemblage. Significant arenaceous forms are *Ammomarginulina foliaceus*, *Gaudryina*, *Textularia* and *Trochammina*.

This assemblage can be subdivided into two facies, the mouth-central facies and the inner-marginal facies.

The mouth-central facies seems to be extending through Stations 85, 82, 75, 61, 55, etc. situated in the area from the mouth to the central part of the bay. It is characterized by rich species, by the low percentage of *Trochammina* and *Ammonia*, and also by the very low ratio *Ammonia beccarii* "forma A" to *A. beccarii tepida* (1:9 on an average). *Astrononion stelligerum*, *Bolivina folium*, *Cymbaloporeta bradyi*, *Quinqueloculina lamarckiana*, etc. are restricted in this facies.

The other facies is distributed in the inner-marginal part of the bay including Stations 51, 47, 31, 20, etc., and characterized by a little increase of arenaceous forms, especially of *Trochammina* (mainly *T. globigeriniformis*). The frequency of

Ammonia increases remarkably in this facies and the ratio *Ammonia beccarii* "forma A" to *A. beccarii tepida* shows here a little increase, too (1:6 on an average).

III. Cove assemblage (Text-fig. 4, III)

This assemblage seems to be distributed in the coves of the bay, as seen actually at Stations 26 and 28. It consists of *Ammonia* (mainly *A. beccarii tepida* and *A. beccarii* "forma A"), *Elphidium* (dominant species: *E. advena*, *E. hispidulum*, *E. incertum*, *E. translucens*, etc.) and arenaceous forms (mainly *Trochammina globigeriniformis* and *Ammomarginulina foliaceus*) and is characterized by the sharp decrease of Miliolidae and increase of *Ammonia*. The frequency of *Ammonia beccarii* "forma A" shows here a value nearly equal to that of *A. beccarii tepida*.

IV. Wharf-area assemblage (Text-fig. 4, IV)

The assemblage found at Station 34 is particular in its composition. It is dominated by *Ammonia beccarii* "forma A" and arenaceous foraminifers, mainly *Trochammina globigeriniformis*. Other arenaceous species found commonly in the assemblage are: *Nouria polymorphinoides*, *Haplophragmoides canariensis*, *Reophax gracilis*, *Spiroplectammina bifurcata*, *Textularia* cf. *earlandi*, *Trochammina inflata*. *Elphidium advena* and *E. incertum* also occur in significant frequencies. The almost complete absence of *Ammonia beccarii tepida* in this assemblage is of particular interest, because the number of this subspecies increases steadily with the distance from the coves.

Living Foraminifera

The distributional pattern of living specimens is referred here only to some species (Fig. 5). In general, the population distribution of living (stained) benthonic foraminifers in 20 g aliquot shows a pattern or tendency similar to those of the total foraminiferal population all over the bay, except in the inner-marginal area and coves where the total population is very small.

Text-figure 6 shows the size of total and living populations and the ratios living population to total population and living species to total species at each station.

At Stations 34, 26, 28, 31, and 51 situated in the inner-marginal area and the coves, the total population of foraminifers was very small as mentioned already, but it contained a considerable number of living individuals, though the number of living species included is relatively small as compared with populations in other parts of the bay. Here, a high ratio the living species to the total species is maintained. Such a poor population and a few species number in the inner-marginal area and coves may be due to the particular ecological condition of these areas, especially lower chlorinity and excess organic debris which will consume oxygen on one side and produce some harmful substances such as methane or H_2S on the other side. Consequently, these areas are occupied by the assemblage of particular foraminifers, predominated by *Ammonia beccarii tepida* and *A. beccarii* "forma A", accompanied

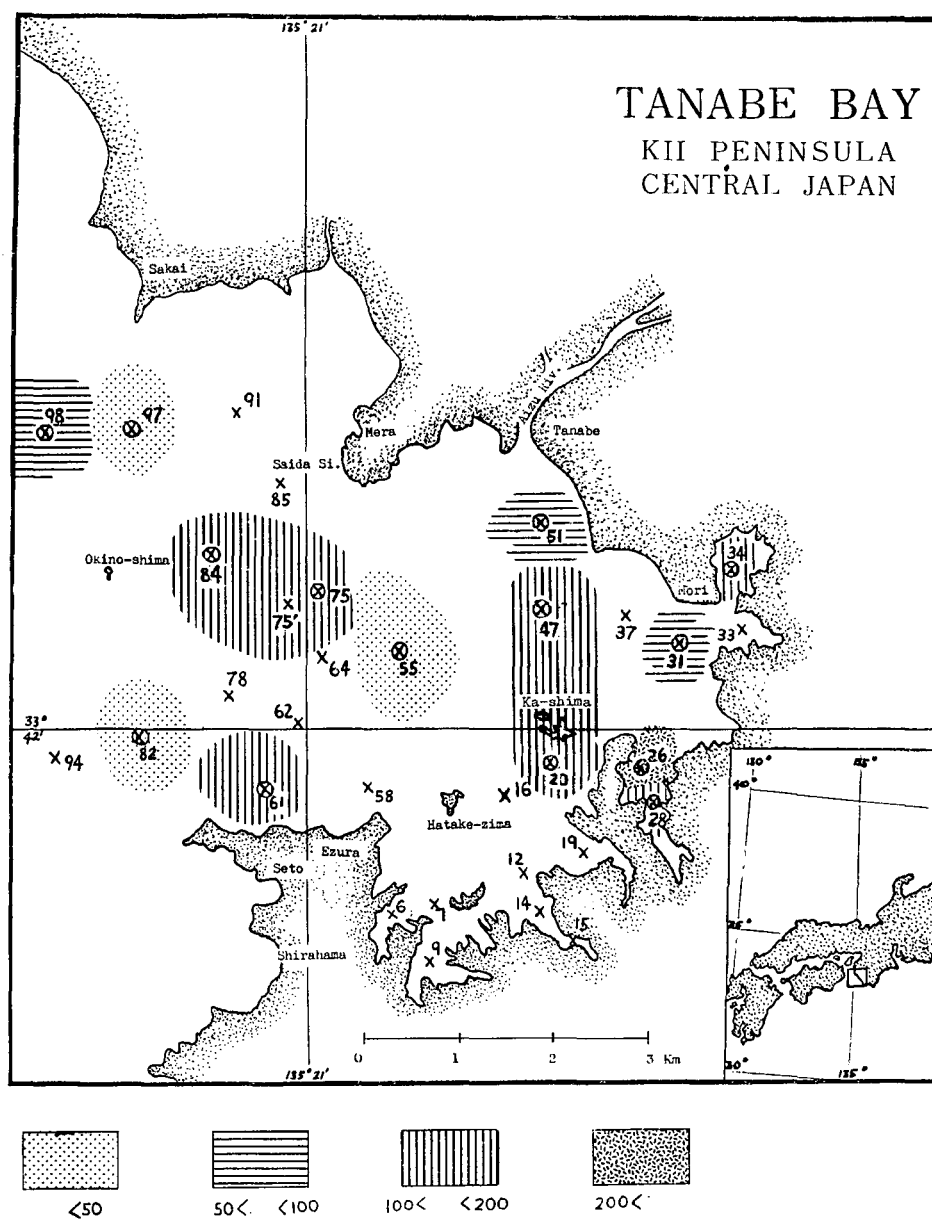


Fig. 5. Distribution of the living population of benthonic Foraminifera in Tanabe Bay (in 20 g aliquot).

with *Ammomarginulina foliaceus*, *Haplophragmoides* sp., *Textularia* cf. *earlandi*, *Trochammina globigeriniformis*, etc. Especially, it is remarkable that nearly 80% of the living foraminifers at Station 34 in the cove of Mori consisted of *Ammonia beccarii* "forma A".

The large living population found in these areas may be due to much less activity of the current and wave which otherwise may carry off the bottom sediments including living foraminifers and thus alter their distribution. Nevertheless, the dead population is relatively small there, this means less accumulation of dead tests in this area than in other areas. Such a phenomenon was recognized by PARKER and ATHEARN (1959) in the marsh in Poponneset Bay, Massachusetts. In that marsh,

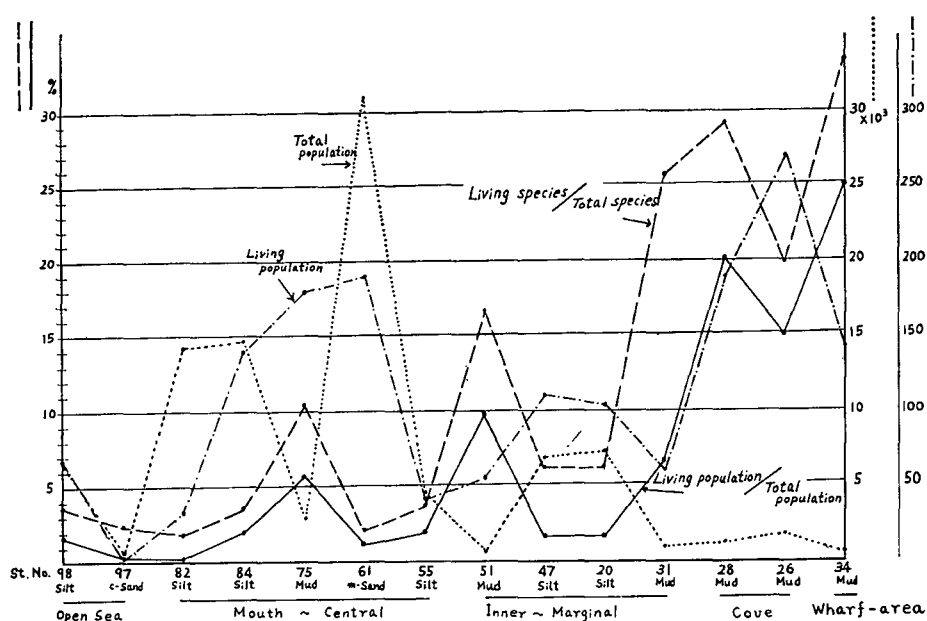


Fig. 6. Regional succession of the total (.....) and living (— · — · —) foraminiferal populations, and of ratios-number of living species to total species (— — —) and living population to total population (———).

the calcareous foraminifers were represented for the most part by living specimens and very few dead ones were observed. They concluded that calcareous specimens were rapidly destroyed after death presumably due either to the ability of the living form to resist acidity or to a postulated increase in acidity immediately below the sediment surface, more probably the latter. The uniform value of pH of the bottom water measured by the writers in Tanabe Bay may supports the latter probability.

At Stations 84, 82, and 61, the total population was very large as shown in Fig. 6 and this resulted in the decline of the ratio the living population to total population and of the ratio the number of living species to that of the total species. The popu-

lations at Stations 98, 55, 47 and 20 were similarly found on the rather coarse sediment against the populations at Stations 84, 82 and 61 which were thriving in sands of fine to medium size. The large total populations including the small living populations may be due to a rapid accumulation of foraminiferal tests.

As in the case of thanatocoenoses, the areal distributions of some living foraminifers in Tanabe Bay are suggested as follows;

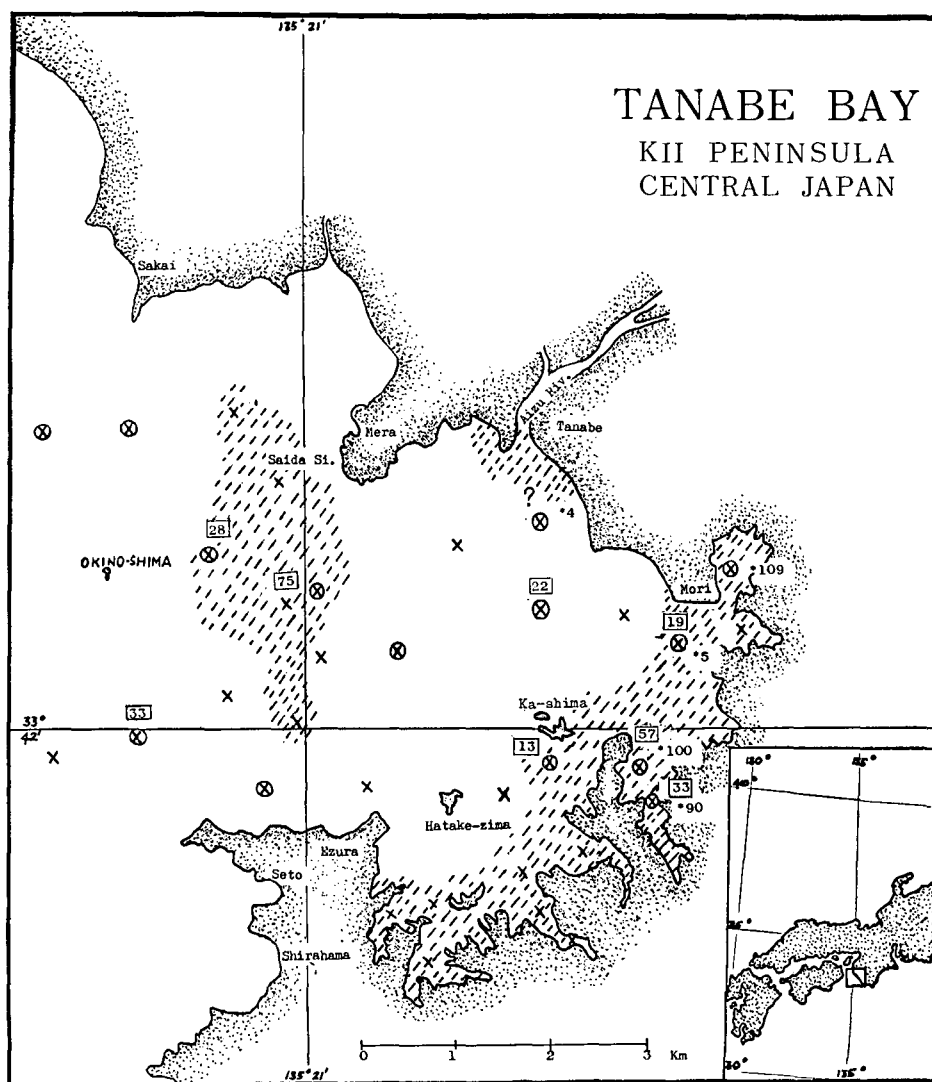


Fig. 7. Distribution of living *Ammonia beccarii tepida* and *Ammonia beccarii* "forma A". The numbers of specimens in 20 g aliquat. The numbers in square for *A. beccarii tepida* and those with asterisk for *A. beccarii* "forma A." In the region covered by broken lines the chlorinity of the bottom water was less than 19.11% in April, 1966, whereas in other parts of the bay it was higher than 19.11%.

Amphistegina radiata and *A. madagascariensis* are distributed in the open sea and the bay mouth area, together with *Operculina ammonoides*, *Textularia articulata*, etc.

Ammomarginulina foliaceus and *Ammonia beccarii tepida* are widely distributed all over the bay.

Florilus japonicus and *Trochammina globigeriniformis* are distributed in the central part to the coves, though their empty tests are found in the bay mouth area.

Ammonia beccarii "forma A", *Haplophragmoides canariensis*, and *Nonionella miocenica* are distributed in the innermost part of the bay, including coves.

Ammonia beccarii tepida and *A. beccarii* "forma A" have been very frequently found in the clay or mud beds intercalated in the Alluvium and the Pleistocene marine terrace deposits on the Pacific coast of Southwest Japan (CHIJI, 1963, 1964; Ariake Bay Res. Group, 1965; KONDA, 1967, etc.). The frequency of *Ammonia beccarii* and the distributions of the two varieties or subspecies and the ratio between the two in Tanabe Bay (Fig. 7) may be regarded as useful informations on the paleoecological or paleophysical conditions of the sedimentary environment in the Quaternary.

Planktonic Foraminifera

Planktonic foraminifers were found in all samples examined, except the one from Station 34 in the cove of Mori. The distributions of planktonic foraminifers in the bay are shown in Fig. 8, the largest population (1515 specimens per 20 g aliquot) was found at Station 82 in the southern part of the bay mouth area. In general, the number of planktonic foraminifers in bottom sediments decreases towards the inner part of the bay. The complete absence of planktonic foraminifers in the cove of Mori may be due to the breakwater at the entrance to the cove, which will inhibit the inflow of the oceanic water.

This distribution pattern of extant planktonic foraminifers agrees with that of the open sea water influx in the bay in the summer season traced by FUSE and HARADA (1960) on the distributions of the water colour and transparency.

Foraminiferal reference list

The following is an alphabetical list of the Foraminifera species which are shown in systematically arranged plates of this paper. Any detailed taxonomic discussions or complete synonymy of respective species are not given, but a brief note on some questionable species.

Benthonic Foraminifera

Ammobaculites agglutinans (D'ORBIGNY).—Pl. VI, fig. 3.

Ammobaculites agglutinans, BARKER, 1960; Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 66, pl. 33, figs. 19–21, 24–26,

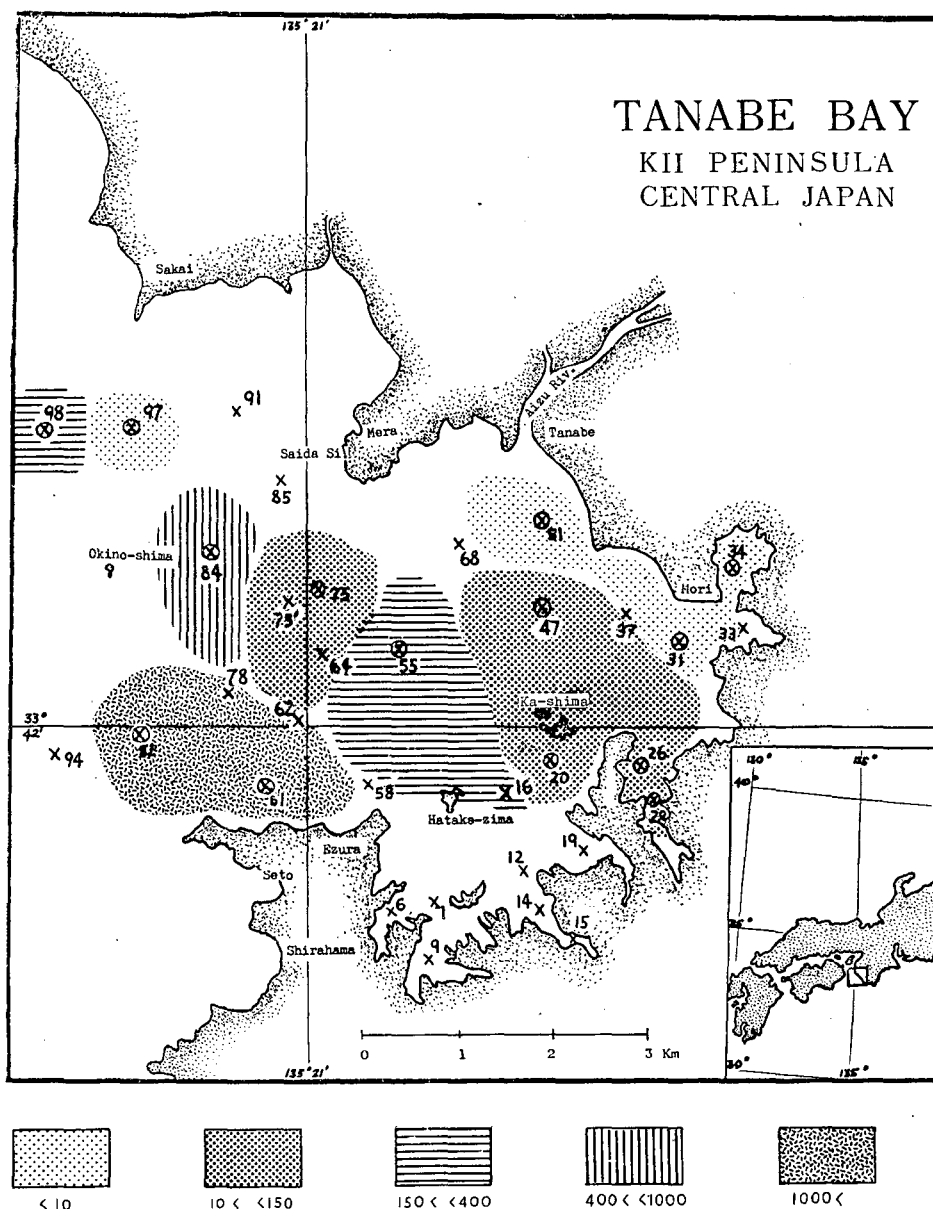


Fig. 8. Distribution of the total population of planktonic Foraminifera in Tanabe Bay (in 20 g aliquot).

Ammomarginulina foliaceus (BRADY).—Pl. VI, fig. 4.

Ammobaculites cf. *foliaceus*, CUSHMAN & STONE, 1949, Contr. Cush. Found. Foram. Res., vol. 25, pt. 4, p. 76, pl. 13, fig. 14.

Ammomarginulina foliaceus, BARKER, 1960, Taxonomic Note, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 68, pl. 33, figs. 20–25.

Ammonia beccarii (LINNÉ) var. *tepida* (CUSHMAN).—Pl. XII, figs. 3a, b, 4a, b.

Rotalia beccarii (LINNÉ) var. *tepida*, CUSHMAN, 1931, U.S. Nat. Mus. Bull. 104, pt. 8, p. 61, pl. 13, figs. 3a-c.

Strebulus beccarii (LINNÉ) var. *tepida*, TODD & BRONNIMANN, 1957, Cush. Found. Foram. Res., Spec. Publ. 3, p. 38, pl. 10, figs. 5–11.

Strebulus beccarii (LINNÉ) var. *tepida*, ANDERSEN, 1961, Geol. Bull., La. Geol. Surv., no. 35, pt. 2, p. 99, pl. 22, figs. 2a, b.

Ammonia beccarii (LINNÉ) “forma A”—Pl. XII, figs. 2a, b.

Rotalia beccarii (LINNÉ) var. A, ISHIWADA, 1958, Rept. Geol. Surv. Japan, no. 180, pl. 2, figs. 1–8.

Strebulus beccarii, CHIJI, 1963, Bull. Osaka Mus. Nat. Hist., no. 16, p. 65, pl. 7, figs. 4a, b.

Strebulus beccarii (LINNÉ) “forma A”, CHIJI, 1964, Rept. Geol. Surv. Hamamatsu City (Hamamatsu City Government), pl. 1, figs. 9a-c, 11a, b.

The present form has no umbilical boss, the sutures are rather straight and radial, and limbate, slightly raised towards the peripheral margin on the ventral side. On the dorsal side, the sutures are limbate and usually not raised. The periphery rounded and sometimes slightly lobulate in later stages of coiling. HOFKER (1951) separated *A. batavus* from *A. beccarii* i. a., as a smaller and less compressed form. The present form somewhat resembles *A. batavus* figured by FEYLING-HANSEN (1964), which came from the Post Glacial deposits in the Oslofjord area.

Amphistegina madagascariensis D'ORBIGNY.—Pl. XIV, figs. 3a, b.

Amphistegina madagascariensis, TODD, 1965, U.S. Nat. Mus. Bull. 161, pt. 4, p. 34, pl. 11, fig. 3, pl. 12, figs. 1, 2.

Amphistegina radiata (FICHTEL & MOLL).—Pl. XIV, figs. 2a, b.

Amphistegina radiata, TODD, 1965, *ibid.*, pt. 4, p. 34, pl. 13, figs. 1–3, pl. 14, figs. 1–3.

Anomalina globulosa CHAPMAN & PARR.—Pl. XV, figs. 15a, b.

Anomalina globulosa, BARKER, 1960, Taxonomic Note, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 194, pl. 94, figs. 4–5.

Articulina conico-articulata BATCH.—Pl. X, fig. 10.

Articulina conico-articulata, MILLETT, 1898, Jour. Roy. Micro. Soc., pt. 2, p. 511, pl. 12, figs. 9, 10.

Astrononion stelligerium (D'ORBIGNY).—Pl. XV, fig. 11.

Astrononion stelligerium, BARKER, 1960, Taxonomic Note, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 224, pl. 109, figs. 3, 4.

Bolivina glutinata EGGER.—Pl. X, fig. 13.

Bolivina glutinata, CUSHMAN, 1937, Cush. Lab. Foram. Res., Spec. Publ. 9, p. 137,

- pl. 16, fig. 25.
- Bolivina robusta* BRADY.—Pl. X, fig. 15.
- Bolivina robusta*, CUSHMAN, 1942, U.S. Nat. Mus. Bull. 161, pt. 3, p. 17, pl. 6, fig. 2.
- Bolivina subangularis* BARDY.—Pl. X, fig. 14.
- Bolivina subangularis*, CUSHMAN, 1937, Cush. Lab. Foram. Res., Spec. Publ. 9, p. 133, pl. 17, figs. 5–10.
- Brizalina seminuda* (CUSHMAN).—Pl. X, fig. 16.
- Bolivina seminuda*, CUSHMAN, 1937, Cush. Lab. Foram. Res. Spec. Publ. 9, p. 142, pl. 18, figs. 13–15.
- Brizalina striatula* (CUSHMAN).—Pl. X, figs. 17, 18.
- Bolivina striatula*, CUSHMAN, 1937, *ibid.*, p. 154, pl. 18, figs. 30, 31.
- Buliminella elegantissima* D'ORBIGNY.—Pl. X, fig. 12.
- Buliminella elegantissima*, BARKER 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 104, pl. 50, figs. 20, 21.
- Calcarina hispida* BRADY.—Pl. XII, figs. 8a, b.
- Calcarina hispida*, GRAHAM & MILITANTE, 1959, Stanford Univ. Publ. Geol. Sci., vol. 6, no. 2, p. 106, pl. 17, figs. 5–7.
- Cellanthus craticulatus* (FICHTEL & MOLL).—Pl. XIII, fig. 9.
- Polystomella craticulata*, CUSHMAN, 1914, U.S. Nat. Mus. Bull. 71, pt. 4, p. 34, pl. 19, figs. 4a–b.
- Elphidium craticulatum*, CUSHMAN, 1939, U.S. Geol. Surv., Prof. Paper 191, p. 56, pl. 15, figs. 14–17.
- Cibicides lobatulus* (WALKER & JACOB).—Pl. XIV, figs. 7a–b.
- Cibicides lobatula*, CUSHMAN, 1931, U.S. Nat. Mus. Bull. 104, pt. 8, p. 118, pl. 21, figs. 3a–c.
- Cibicides pseudoungerianus* (CUSHMAN).—Pl. XIV, figs. 5a, b.
- Cibicides pseudoungeriana*, CUSHMAN, 1931, *ibid.*, p. 123, pl. 22, figs. 3–7.
- Cibicides refulgens* MONTFORT.—Pl. XIV, figs. 6a, b.
- Cibicides refulgens*, CUSHMAN, 1931, *ibid.*, p. 116, pl. 21, figs. 2a–c.
- Cibicides subhaidingerii* PARR.—Pl. XIV, figs. 4a–c.
- Cibicides subhaidingerii*, BARKER, 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 196, pl. 95, fig. 7.
- Cribr stomoides columbiense* (CUSHMAN).—Pl. VI, figs. 2a, b.
- Haplophragmoides columbiense*, CUSHMAN & McCULLOCH, 1939, Allan Hancock Pacific Exped., vol. 6, no. 1, p. 72 pl. 5, figs. 8–10.
- Cyclogyra involvens* (REUSS).—Pl. VII, fig. 5,
- Cornuspira involvens*, CUSHMAN, 1921, U.S. Nat. Mus. Bull. 100, p. 389, pl. 77, figs. 3, 4.
- Cymbaloporeta bradyi* (CUSHMAN).—Pl. XIV, figs. 9a, b.
- Cymbaloporeta bradyi*, BARKER, 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 210, pl. 102, fig. 14.

Elphidium advena (CUSHMAN).—Pl. XIII, fig. 1.

Elphidium advenum, CUSHMAN, 1939, U.S. Geol. Surv. Prof. Paper 191, p. 60, pl. 16, figs. 31–35.

Elphidium crispum (LINNÉ).—Pl. XIII, fig. 2.

Elphidium crispum, CUSHMAN 1939, *ibid.*, p. 50, pl. 13, figs. 17–21.

Elphidium hispidulum CUSHMAN.—Pl. XIII, fig. 3.

Elphidium hispidulum CUSHMAN, 1936, Contr. Cush. Lab. Foram. Res., vol. 12, p. 83, pl. 14, figs. 13a, b.

Elphidium incertum (WILLIAMSON).—Pl. XIII, fig. 7.

Elphidium subincertum ASANO, 1950, Ill. Cat. Japan. Tert. Smaller Foram., pt. 1, p. 10, figs. 56, 57.

Elphidium incertum, PHLEGER, 1952, Contr. Cush. Found. Foram. Res., vol. 3, p. 83, pl. 14, fig. 7.

Elphidium incertum, LOEBLICH & TAPPAN, 1953, Smith. Misce. Coll., vol. 3, no. 7, p. 100.

LOEBLICH and TAPPAN (1953) gave a full discussion of *E. incertum* to make the confusion cease concerning its identification. Unfortunately they did not give any figure of the species, but indicated that the only American Arctic reference to *E. incertum* which possibly may be correctly identified is that of PHLEGER (1952), as it has the sutural slits converging at the umbilical depression. *E. subincertum* described by ASANO (1950) having several slit-like openings along the sutural depression is considered to be a synonym of the above-mentioned species figured by PHLEGER.

Elphidium jenseni (CUSHMAN).—Pl. XIII, fig. 5.

Elphidium jenseni, CUSHMAN, 1933, U.S. Nat. Mus. Bull. 161, pt. 2, p. 48, pl. 11, figs. 6, 7.

Elphidium matagordanum (KORNFELD).—Pl. XIII, fig. 6.

Elphidium matagordanum, PAKER, PHLEGER & PEIRSON, 1953, Cush. Lab. Foram. Res., Spec. Publ. 2, p. 8, pl. 3, figs. 24, 25.

Elphidium striatopunctatum (FICHTEL & MOLL) ?.—Pl. XIII, fig. 4.

Polystomella striatopunctatus, BRADY, 1884, Challenger Report, vol. 9, pl. 109, fig. 23.

BARKER (1960) tentatively referred this species to *E. incertum* for the reason that BRADY's specimen resembles *E. incertum* figured by MACFADYEN (1932) and PHLEGER (1952). However, the openings along the sutural depression are not slit-like in BRADY's specimen in later stages of coiling, but distinctly arched. Thus, BRADY's specimen is not likely identical with PHLEGER's specimen.

Elphidium translucens NATLAND.—Pl. XIII, fig. 8.

Elphidium translucens, CUSHMAN 1939, U.S. Geol. Surv. Prof. Paper 191, p. 65, pl. 20, figs. 7a, b.

Florilus grateloupi (D'ORBIGNY).—Pl. XV, figs. 9a, b.

Nonion grateloupi, CUSHMAN, 1939, *ibid.*, p. 21, pl. 6, figs. 1–7.

Florilus japonicus (ASANO).—Pl. XV, figs. 10a, b.

Pseudononion japonicum, ASANO, 1950, Ill. Cat. Japan. Tert. Smaller Foram., pt.

- 1, p. 5, figs. 19–21.
- Fursenkoina pauciloculata* (BRADY).—Pl. XV, figs. 2a, b.
- Virgulina pauciloculata*, BARKER, 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 106, pl. 52, figs. 4, 5.
- Gaudryina robusta* CUSHMAN.—Pl. VII, fig. 4.
- Gaudryina robusta*, CUSHMAN, 1921, U.S. Nat. Mus. Bull. 100, p. 152, pl. 30, figs. 1a–c.
- Gavelinopsis* cf. *preageri* (HERON-ALLEN & EARLAND).—Pl. XI, figs. 8a, b., 9a, b.
- Discorbis* (?) *preageri*, CUSHMAN, 1931, U.S. Nat. Mus. Bull. 104, p. 30, pl. 6, figs. 4a–c.
- Gavelinopsis praegeri*, HOFKER, 1951, Foram. Siboga Exped., pt. 3, p. 486, figs. 332–334.
- Glabratella australensis* (HERON-ALLEN & EARLAND).—Pl. XI, figs. 11a–c.
- Discorbis australensis*, ASANO, 1951, Ill. Cat. Japan. Tert. Smaller Foram. pt. 14, p. 2, figs. 6, 7.
- Pileolina* (?) *australensis*, BARKER, 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 184, pl. 89, figs. 2–4.
- Glabratella opercularis* (D'ORBIGNY).—Pl. XI, figs. 12a b.
- Discorbis opercularis*, ASANO, 1951, Ill. Cat. Japan. Tert. Smaller Foram. pt. 14, p. 2, figs. 11–13.
- Pileolina* (?) *opercularis*, BARKER, 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 184, pl. 89, figs. 8, 9.
- Glabratella opercularis* (D'ORBIGNY) *nakamurai* (ASANO).—Pl. XI, figs. 13a b.
- Discorbis nakamurai* ASANO, 1951, Ill. Cat. Japan. Tert. Smaller Foram. pt. 14, p. 2, figs. 8–10.
- Pileolina* (?) *opercularis nakamurai*, UCHIO, 1962, Publ. Seto Mar. Biol. Lab. vol. X, no. 1, p. 139.
- Glabratella patelliformis* (BRADY).—Pl. XI, figs. 10a, b.
- Discorbis patelliformis*, CUSHMAN, 1931, U.S. Nat. Mus. Bull. 104, pt. 8, p. 29.
- Pileolina* (?) *patelliformis*, BARKER, 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 184, pl. 89, fig. 1.
- Globocassidulina subglobosa* (BRADY).—Pl. XV, figs. 5a, b.
- Cassidulina subglobosa*, BARKER, 1960, *ibid.*, p. 112, pl. 54, fig. 17.
- Hanzawaia nipponica* ASANO.—Pl. XV, figs. 14a, b.
- Hanzawaia nipponica* ASANO, 1944, Jour. Geol. Soc. Japan, vol. 51, no. 606, p. 99, pl. 4, figs. 1a, b, 2a, b.
- Hauerina fragilissima* (BRADY).—Pl. X, fig. 9.
- Hauerina fragilissima*, GRAHAM & MILITANTE, 1959, Stanford Univ. Publ. Geol. Sci., vol. 6, no. 2, p. 35, pl. 3, fig. 9.
- Hauerina pacifica* CUSHMAN.—Pl. X, fig. 8.
- Hauerina pacifica* CUSHMAN, 1917, U.S. Nat. Mus. Bull. 71, pt. 6, p. 64, pl. 21, fig. 2.

Lagena striata (D'ORBIGNY).—Pl. X, fig. 11.

Lagena striata, BARKER, 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 118, pl. 57, figs. 19, 28.

Loxostomoides durrandii (MILLETT).—Pl. XV, fig. 3.

Bolivina durrandii MILLETT, 1900, Jour. Roy. Micro. Soc., pt. 9, p. 544, pl. 6, fig. 7.

Loxostoma durrandii, CUSHMAN, 1937, Cush. Lab. Foram. Res., Spec. Publ. 9, p. 191, pl. 22, fig. 6.

Loxostomoides limbatum (BRADY).—Pl. XV, fig. 4.

Bolivina limbata, MILLETT, 1900, Jour. Roy. Micro. Soc., pt. 9, p. 543,

Loxostoma limbatum, CUSHMAN, 1939, Cush. Lab. Foram. Res., Spec. Publ. 9, p. 186, pl. 21, figs. 26–29.

Massilina inaequalis CUSHMAN.—Pl. X, figs. 1a, b.

Massilina inaequalis, CUSHMAN, 1929, U.S. Nat. Mus. Bull. 104, pt. 6, p. 38, pl. 7, figs. 1, 2.

Massilina planata CUSHMAN.—Pl. X, fig. 2.

Massilina planata CUSHMAN, 1932, U.S. Nat. Mus. Bull. 161, p. 31, pl. 8, figs. 8a, b.

Melonis nicobarense (CUSHMAN).—Pl. XV, fig. 13.

Nonion nicobarense CUSHMAN, 1936, Contr. Cush. Lab. Foram. Res., vol. 12, p. 67 pl. 12, figs. 9a, b.

Miliolinella circularis (BORENEMANN).—Pl. X, figs. 3a, b, 4.

Miliolina circularis, MILLETT, 1898, Jour. Roy. Micro. Soc., pt. 14, p. 499, pl. 11, figs. 1a–c, 3a–c.

Triloculina circularis, CUSHMAN, 1917, U.S. Nat. Mus. Bull. 71, pt. 6, p. 67, text fig. 33; pl. 25, figs. 4a–c; pl. 26, figs. 1a–c.

Miliolinella circularis, ASANO, 1951, Ill. Cat. Japan. Tert. Smaller Foram. pt. 6, p. 9, figs. 65–67.

Miliolinella oblonga (MONTAGU).—Pl. X, fig. 5.

Miliolinella oblonga, ASANO, 1951, *ibid.*, pt. 6, p. 10, figs. 68, 69.

Neoconorbina terquemi (RZEHA).—Pl. XI, figs. 1a, b.

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Discorbina imperatoria D'ORBIGNY var. *globosa* MILLETT, 1903, Jour. Roy. Micro. Soc., pt. 12, p. 701, pl. 7, fig. 6a–c.
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- Pyrgo denticulata* (BRADY).—Pl. VIII, fig. 2.
Pyrgo denticulata, CUSHMAN 1929, U.S. Nat. Mus. Bull. 104, pt. 6, p. 69, pl. 18, figs. 3, 4.
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Quinqueloculina agglutinans, CUSHMAN, 1917, *ibid.*, Bull. 71, pt. 6, p. 42, pl. 9, figs. 1a–c.
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- Quinqueloculina elongata* NATLAND.—Pl. VIII, fig. 10.
- Quinqueloculina elongata*, ASANO, 1959, *ibid.*, pt. 6, p. 4, figs. 20-22.
- Quinqueloculina granulosa* NATLAND.—Pl. VIII, figs. 11a, b.
- Quinqueloculina granulosa* NATLAND, 1938, Scripps Inst. Oceanogr., Bull., vol. 4, no. 5, p. 141. (Ellis & Messina; Catalogue of Foraminifera)
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- Quinqueloculina lamarckiana*, CUSHMAN, 1929, *ibid.*, Bull. 104, pt. 6, p. 26, pl. 2, figs. 6a-c.
- Quinqueloculina* cf. *lata* TERQUEM.—Pl. IX, figs. 1a, b.
- Quinqueloculina lata*, CUSHMAN, 1944, Cush. Lab. Foram. Res., Spec. Publ. 12, p. 14, pl. 2, fig. 16.
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- Quinqueloculina reticulata*, ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 6, p. 6, figs. 35, 36.
- Quinqueloculina seminulum* (LINNÉ).—Pl. IX, figs. 6a, b.
- Quinqueloculina seminulum*, ASANO, 1951, *ibid.*, pt. 6, p. 7, figs. 43-45.
- Quinqueloculina subagglutinata* ASANO.—Pl. IX, figs. 8a-c.
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- Quinqueloculina sulcata* D'ORBIGNY.—Pl. IX, figs. 7a, b.
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- pl. 7, figs. 5-8.
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- Quinqueloculina vulgaris*, CUSHMAN, 1929 *ibid.*, Bull. 104, pt. 6, p. 25, pl. 2, figs. 3a-c.
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- Reophax gracilis*, HADA, 1931, Sci. Rept., Tohoku Imp. Univ., ser. 4, vol. 6, no. 1, p. 61, fig. 13.
- Reussella aculeata* CUSHMAN.—Pl. X, fig. 19.
- Reussella aculeata* CUSHMAN, 1945, Contr. Cush. Lab. Foram. Res., vol. 21, pt. 2, p. 41, pl. 7, figs. 10, 11.
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- Rosalina rugosa* D'ORBIGNY.—Pl. XI, figs. 4a, b.
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- Rosalina subbertheloti* (CUSHMAN).—Pl. XI, fig. 7.
- Rosalina subbertheloti*, TODD, 1965, *ibid.*, Bull. 161, pt. 4, p. 13, pl. 4, fig. 4.
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- Rosalina vilardeboana*, TODD, 1965, *ibid.*, Bull. 161, pt. 4, p. 13, pl. 3, figs. 2, 5.
- Scutuloris* sp. A.—Pl. X, figs. 6a-c, 7a-c.
- Sigmavirgulina tortuosa* (BRADY).—Pl. XV, fig. 1.
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Spiroloculina corrugata CUSHMAN & TODD, 1944, Cush. Lab. Foram. Res., Spec. Publ. 11, p. 61, pl. 8, figs. 22–25.
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Textularia pseudogramen, BARKER, 1960, Taxonomic Notes, Soc. Econ. Paleont. & Min. Spec. Publ. 9, p. 88, pl. 43, figs. 9, 10.
- Textularia secasensis* LALICKER & McCULLOCH.—Pl. VI, figs. 6a, b.
Textularia secasensis LALICKER & McCULLOCH, 1940, Allan Hancock Pacific Exped. vol. 6, no. 2, p. 141, pl. 16, figs. 24a–c.
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Triloculina affinis, CUSHMAN, 1932, U.S. Nat. Mus. Bull. 161, pt. 1, p. 58, pl. 13, figs. 2a, b.
- Triloculina oblonga* (MONTAGU).—Pl. VIII, figs. 1a, b.
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Trochammina inflata (MONTAGU).—Pl. VII, 1a, b.
Trochammina inflata, CHUSMAN & McCULLOCH, 1939, Allan Hancock Pacific Exped. vol. 6, no. 1, p. 120, pl. 11, fig. 2.
Trochammina pacifica CUSHMAN var. *simplex* CUSHMAN & McCULLOCH.—Pl. VII, figs. 2a, b.
Trochammina pacifica simplex CUSHMAN & McCULLOCH, 1939, *ibid.*, vol. 6, no. 1, p. 104, pl. 11, fig. 4.
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Vertebralina striata D'ORBIGNY.—Pl. VII, fig. 8,
Vertebralina striata, GRAHAM & MILITANTE, 1959, Stanford Univ. Publ., Geol. Sci., vol. 6, no. 2, p. 60, pl. 9, figs. 11, 12a, b.
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Planispirina auriculata, CUSHMAN, 1929, U.S. Nat. Mus. Bull. 104, pt. 6, p. 93, pl. 22, figs. 3a, b.
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Planktonic Foraminifera

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Globigerina bulloides, PARKER, 1962, Micropaleont., vol. 8, no. 2, p. 221, pl. 1, figs. 1–8.
Globigerina quinqueloba NATLAND.—Pl. XIII, figs. 12a, b.
Globigerina quinqueloba, PARKER, 1962, *ibid.*, vol. 8, no. 2, p. 225, pl. 2, figs. 15, 16.
Globigerinoides triloba (REUSS) *immatura* LEROY.—Pl. XIII, figs. 15a, b.
Globigerinoides triloba immatura, BLOW, 1959, Amer. Paleont., vol. 39, no. 178, p. 188, pl. 11, figs. 62a, b.

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Globigerinoides triloba triloba, BLOW, 1959, *ibid.*, vol. 39, no. 178, p. 187, pl. 11, figs. 60a, b.
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Table 3. Distribution of Foraminifera in Tanabe Bay, Kii Peninsula.

(pp. 118–125)

Table 3. Distribution of Foraminifera in Tanabe Bay, Kii Peninsula

BENTHONIC FORAMINIFERA

Station No.	98	97	82	84	75	61
Species						
1 <i>Ammobaculites agglutinans</i>	—	—	—	—	—	—
2 <i>Ammonia marginulina foliaceus</i>	—	—	—	5, (139,)Vr	9, 3(134, 45) F	—
3 <i>Ammonia beccarii tepida</i>	—	—	22, 1(724, 33) F	24, 1(667, 28) F	22, 5(328, 75) C	2, (127,)Vr
4 <i>A. beccarii</i> "forma A"	—	2, (4,)Vr	2, (66,)Vr	5, (140,)R	1, (15,)Vr	1, (63,)Vr
5 <i>A. nipponica</i>	—	—	—	—	—	—
6 <i>A. ketenziensis angulata</i>	1, (22,)Vr	—	1, (33,)Vr	—	—	—
7 <i>Ammonia sp.</i>	—	—	—	—	1, (15,)Vr	—
8 <i>Amphistegina madagascariensis</i>	3, (68,)R	189, (353,)VA	—	—	—	—
9 <i>A. radiata</i>	52, 1(1137, 22) C	53, (99,)C	11, (362,)R	9, (250,)R	1, (15,)Vr	—
10 <i>Angulodiscorbis quadrangularis</i>	—	—	—	1, (28,)Vr	—	2, (127,)Vr
11 <i>Anomalina globulosa</i>	1, (22,)Vr	—	8, (263,)R	3, (83,)Vr	—	—
12 <i>A. grosserugosa</i>	—	—	1, (33,)Vr	1, (28,)Vr	—	—
13 <i>A. spp.</i>	1, (22,)Vr	—	1, (33,)Vr	1, (28, 28) Vr	—	4, (253,)Vr
14 <i>Articulina conico-articulata</i>	—	—	—	—	—	3, (190,)Vr
15 <i>Astrononion stelligerium</i>	—	—	2, (66,)Vr	1, (28,)Vr	—	1, (63,)Vr
16 <i>Bolivina glutinata</i>	2, (44,)Vr	1, (2,)Vr	7, (230,)R	6, (168,)R	1, (15,)Vr	1, (63,)Vr
17 <i>B. robusta</i>	7, (153,)R	—	11, (362,)R	13, 1(361, 28) R	—	—
18 <i>B. subangularis</i>	2, (44,)Vr	—	3, (99,)Vr	—	—	—
19 <i>Bolivina elegans</i>	1, (22,)Vr	—	1, (33,)Vr	—	—	—
20 <i>B. folium</i>	—	—	2, (66,)Vr	4, (111,)Vr	1, (15,)Vr	3, (190,)Vr
21 <i>Brizalina acerosa</i>	—	—	—	—	—	—
22 <i>B. compacta</i>	—	—	—	—	—	—
23 <i>B. seminuda</i>	1, (22,)Vr	—	1, (33,)Vr	6, (168,)R	3, (45,)R	1, (63,)Vr
24 <i>B. spatula</i>	—	—	2, (66,)Vr	—	—	—
25 <i>B. striatula</i>	2, (44,)Vr	—	7, (230,)R	13, (361,)R	1, (15,)Vr	3, (190,)Vr
26 <i>B. variabilis</i>	—	—	1, (33,)Vr	2, (56,)Vr	—	4, (253,)Vr
27 <i>Bulimina aculeata</i>	—	—	—	—	—	—
28 <i>B. elongata subulata</i>	—	—	3, (99,)Vr	—	—	—
29 <i>B. marginata</i>	1, (22,)Vr	—	3, (99,)Vr	—	—	5, (316,)R
30 <i>B. subornata</i>	—	—	—	2, (56,)Vr	—	—
31 <i>B. sp.</i>	—	—	—	—	—	—
32 <i>Buliminella elegantissima</i>	—	—	5, (165,)R	1, (28,)Vr	—	—
33 <i>Calcarina hispida</i>	3, (66,)R	15, (28,)F	—	—	—	—
34 <i>Cassidulina laevigata</i>	—	—	2, (66,)Vr	2, (56,)Vr	—	—
35 <i>C. cf. minuta</i>	—	—	3, (99,)Vr	3, (83,)Vr	—	—
36 <i>C. spp.</i>	—	—	1, (33,)Vr	—	—	2, (127,)Vr
37 <i>Cellanthus craticulatus</i>	—	9, (17,)R	—	1, (28,)Vr	—	—
38 <i>Cibicides aknerianus</i>	—	—	—	5, (139,)Vr	—	—
39 <i>C. lobatulus</i>	1, (22,)Vr	1, (2,)Vr	6, (198,)R	9, (250,)R	—	8, (506,)R
40 <i>C. pseudoungerianus</i>	8, (175,)R	—	3, (99,)Vr	4, (111,)Vr	1, (15,)Vr	11, (696,)R
41 <i>C. refulgens</i>	13, (284,)F	3, (6,)Vr	9, (296,)R	12, (333,)R	—	18, (1139,)R
42 <i>C. subhaidingerii</i>	11, (240,)F	2, (4,)Vr	2, (66,)Vr	2, (56,)Vr	—	—
43 <i>C. spp.</i>	1, (22,)Vr	—	2, (66,)Vr	1, (28,)Vr	5, (75,)R	—
44 <i>Clavulina yabei ckiensis</i>	—	—	—	2, (56,)Vr	—	—
45 <i>Conorboides advena</i>	—	—	2, (66,)Vr	—	—	—
46 <i>Cribratoides columbiense</i>	7, (153,)R	1, (2,)Vr	—	—	1, (15,)Vr	—
47 <i>Cyclogyra involvens</i>	—	—	2, (66,)Vr	1, (28,)Vr	—	10, (633,)R
48 <i>Cymbaloporeta bradyi</i>	—	—	1, (33,)Vr	5, (139,)Vr	3, (45,)R	11, (696,)R
49 <i>Discorbinella aotacana</i>	—	—	—	6, (168,)R	—	—
50 <i>Discorbis mira</i>	3, (66,)R	1, (4,)Vr	3, (99,)Vr	1, (28,)Vr	—	6, (380,)R
51 <i>Elphidium advena</i>	1, (22,)Vr	1, (2,)Vr	1, (33,)Vr	1, (28,)Vr	10, 1(150, 15) F	3, (190,)Vr
52 <i>E. articulatum rugulosum</i>	—	—	—	4, (111,)Vr	—	—
53 <i>E. crispum</i>	8, (175,)R	7, (13,)R	3, (99,)Vr	2, (56,)Vr	—	4, (253,)Vr
54 <i>E. discoidale</i>	—	—	—	—	1, (15,)Vr	—
55 <i>E. cf. fimbriatulum</i>	—	—	—	—	—	2, (127,)Vr
56 <i>E. hispidulum</i>	2, (44,)Vr	—	—	1, (28,)Vr	1, (15,)Vr	2, (127,)Vr
57 <i>E. incertum</i>	—	—	—	4, (111,)Vr	1, (15,)Vr	—
58 <i>E. jenseni</i>	—	2, (4,)Vr	—	2, (56,)Vr	—	3, (190,)Vr
59 <i>E. matagordani</i>	1, (22,)Vr	—	6, (198,)R	3, (83,)Vr	3, (45,)R	8, (506,)Vr
60 <i>E. striatopunctatum</i>	1, (22,)Vr	—	—	—	—	—
61 <i>E. translucens</i>	—	—	—	1, (28,)Vr	9, (134,)F	—
62 <i>Epistominella tamana</i>	—	—	—	4, (111,)Vr	1, (15,)Vr	—
63 <i>E. sp. A</i>	—	—	1, (33,)Vr	1, (28,)Vr	—	—
64 <i>Fissurina lacunata</i>	—	—	2, (66,)Vr	—	—	—
65 <i>F. lucida</i>	—	—	1, (33,)Vr	—	—	—
66 <i>F. marginata</i>	—	—	3, (99,)Vr	—	—	—
67 <i>Florilus grateolupi</i>	3, (66,)R	—	9, (296,)R	—	—	2, (127,)Vr
68 <i>F. japonicus</i>	—	—	2, (66,)Vr	6, (168,)R	2, (30,)R	2, (127,)Vr
69 <i>Fursenkoina ishikiensis</i>	—	—	—	—	—	—

55	51	47	20	31	28	26	34	
—	2, I(9, 4)R	—	—	—	—	—	—	1
—	19, 3(84, 13)C	—	5, (65,)Vr	1, (5,)Vr	16, 5(76, 24)F	5, I(36, 7)R	—	2
37, (761,)C	10, (44,)F	17, I(374, 22)F	30, I(388, 13)F	60, 4(288, 19)A	47, 7(223, 33)C	42, 8(299, 57)C	3, (9,)Vr	3
4, (82,)R	2, I(9, 4)R	5, (110,)R	—	8, I(38, 5)R	44, 19(209, 90)C	30, 14(213, 100)C	74, 37(218, 109)A	4
—	2, (9,)R	—	—	—	—	—	—	5
—	—	—	5, (65,)Vr	—	—	1, (7,)Vr	—	6
—	—	1, (22,)Vr	—	—	—	—	—	7
—	1, (4,)Vr	—	—	—	—	—	—	8
—	—	—	—	—	—	—	—	9
—	—	—	—	—	—	1, (7,)Vr	—	10
—	—	1, (22,)Vr	2, (26,)Vr	—	—	—	—	11
3, (62,)R	—	—	—	—	—	—	—	12
1, (21,)Vr	—	—	1, (13,)Vr	—	—	—	—	13
—	—	—	3, I(40, 13)Vr	—	—	1, (7,)Vr	—	14
—	—	—	—	—	—	—	—	15
—	1, (4,)Vr	2, (44,)Vr	—	—	1, (5,)Vr	—	—	16
3, (62,)R	—	—	8, (103,)R	—	—	—	—	17
—	—	—	—	—	—	—	—	18
—	—	—	—	—	—	—	—	19
—	—	—	—	—	—	—	—	20
—	—	—	2, (26,)Vr	—	—	—	—	21
—	—	—	1, (13,)Vr	—	—	2, (14,)Vr	—	22
1, (21,)Vr	—	1, (22,)Vr	3, (40,)Vr	—	—	—	—	23
—	—	—	4, (52,)Vr	1, (5,)Vr	1, (5,)Vr	—	—	24
6, (124,)R	11, (48,)F	2, (44,)Vr	4, (52,)Vr	2, (10,)R	5, (24,)R	4, (28,)R	—	25
—	—	—	—	1, (5,)Vr	2, I(10, 5)Vr	—	—	26
—	—	—	—	—	1, (5,)Vr	1, (7,)Vr	—	27
—	—	1, (22,)Vr	—	—	—	6, (42,)R	—	28
4, (82,)R	—	3, (66,)Vr	1, (13,)Vr	1, (5,)Vr	1, (5,)Vr	5, (36,)R	—	29
—	—	—	—	—	—	—	—	30
2, (41,)Vr	—	—	2, (26,)Vr	—	2, (10,)Vr	—	—	31
1, (21,)Vr	1, (4,)Vr	—	1, (13,)Vr	—	—	2, (14,)Vr	—	32
—	—	—	—	—	—	—	—	33
—	—	—	1, (13,)Vr	—	—	—	—	34
—	—	—	1, (13,)Vr	—	—	—	—	35
—	—	—	—	—	—	—	—	36
—	—	—	—	—	—	1, (7,)Vr	—	37
2, (41,)Vr	1, (4,)Vr	—	—	—	—	—	—	38
—	—	1, (22,)Vr	1, (13,)Vr	—	—	—	1, (3,)Vr	39
—	—	3, (66,)Vr	9, (116,)R	—	1, (5,)Vr	1, (7,)Vr	—	40
—	1, (4,)Vr	5, (110,)R	1, (13,)Vr	—	—	—	—	41
3, (62,)R	—	2, (44,)Vr	—	—	—	—	—	42
1, (21,)Vr	—	—	9, (116,)R	—	—	—	—	43
—	—	—	—	—	—	—	—	44
—	—	—	—	—	—	—	—	45
1, I(21, 21)Vr	—	—	—	—	—	—	—	46
1, (21,)Vr	—	—	5, (65,)Vr	—	—	2, (14,)Vr	—	47
—	—	—	1, (13,)Vr	—	—	—	—	48
—	—	—	—	—	—	—	—	49
—	—	1, (22,)Vr	—	—	—	—	—	50
—	5, I(22, 4)R	9, (198,)R	6, (78,)R	7, (34,)R	1, (5,)Vr	4, (28,)R	17, (50,)F	51
—	—	—	—	—	—	—	—	52
—	4, (18,)R	—	3, (40,)Vr	—	—	2, (14,)Vr	1, (3,)Vr	53
—	—	1, (22,)Vr	2, (26,)Vr	—	—	2, (14,)Vr	—	54
2, I(41, 21)Vr	—	—	1, (13,)Vr	—	—	—	—	55
3, (62,)R	2, (9,)R	4, (88,)R	5, (65,)Vr	—	12, (57,)F	4, (28,)R	1, (3,)Vr	56
6, (124,)R	3, I(13, 4)R	1, (22,)Vr	2, (26,)Vr	6, (29,)R	10, (47,)R	3, I(21, 7)R	1, (3,)Vr	57
—	—	3, (66,)Vr	1, (13,)Vr	—	1, (5,)Vr	—	—	58
12, (247,)F	2, (9,)R	5, (110,)R	5, (65,)Vr	7, (34,)R	5, I(24, 5)R	2, (14,)Vr	—	59
—	—	—	4, (52,)Vr	—	—	—	—	60
—	—	3, (66,)Vr	12, (115,)R	10, (48,)F	6, I(29, 5)R	23, (164,)F	10, I(29, 3)F	61
—	—	—	3, (40,)Vr	—	—	—	—	62
—	—	—	—	—	—	—	—	63
—	—	—	—	—	—	—	—	64
—	—	—	—	—	—	—	—	65
—	—	—	—	—	—	—	—	66
11, (226,)F	—	8, (176,)R	2, I(26, 13)Vr	—	3, I(14, 5)R	—	—	67
4, (82,)R	3, (13,)R	4, I(88, 22)R	10, (129,)R	—	6, (29,)R	4, (28,)R	—	68
—	—	1, (22,)Vr	1, (13,)Vr	—	—	1, I(7, 7)Vr	—	69

Table 3. (Continued)

Station No.		98	97	82	84	75	61
Species							
70	<i>F. pauciloculata</i>	—	—	2, (66,)Vr	4, 1(111, 28)Vr	—	2, (127,)Vr
71	<i>F. schreibersiana</i>	—	—	1, (33,)Vr	1, (28,)Vr	—	—
72	<i>Gaudryina arenaria</i>	—	—	—	1, (28,)Vr	—	—
73	<i>G. robusta</i>	2, (44,)Vr	—	3, (99,)Vr	2, (56,)Vr	—	6, (380,)R
74	<i>G. siphonifera</i>	—	1, (2,)Vr	—	—	—	—
75	<i>G. subglabrata</i>	—	—	2, (66,)Vr	2, (56,)Vr	—	3, (190,)Vr
76	<i>G. spp.</i>	—	—	—	1, (28,)Vr	—	1, (63,)Vr
77	<i>Gaulinopsis cf. praegeri</i>	5, (109,)R	—	15, (494,)R	33, (916,)F	8, 1(119, 15)R	13, (823,)R
78	<i>Glabrata australensis</i>	2, (44,)Vr	—	1, (33,)Vr	2, (56,)Vr	—	—
79	<i>G. opercularis</i>	6, (131,)R	—	10, (329,)R	8, (222,)R	1, (15,)Vr	8, (506,)R
80	<i>G. opercularis nakamurai</i>	4, (87,)R	—	4, (132,)Vr	1, (28,)Vr	1, (15,)Vr	4, (253,)Vr
81	<i>G. patelliformis</i>	1, (22,)Vr	1, (2,)Vr	4, (132,)Vr	6, (168,)R	1, (15,)Vr	16, (1013,)R
82	<i>G. cf. pulvinata</i>	—	—	1, (33,)Vr	—	—	5, (316,)R
83	<i>G. sp. A</i>	—	—	—	—	—	—
84	<i>G. sp. B</i>	—	—	—	—	—	2, (127,)Vr
85	<i>Globobulimina cf. pacifica</i>	—	—	1, (33,)Vr	—	—	—
86	<i>Globocassidulina cf. crassa</i>	—	—	2, (66,)Vr	—	—	—
87	<i>G. subglobosa</i>	2, (44,)Vr	—	4, (132,)Vr	4, (111,)Vr	1, 1(15, 15)Vr	1, (63,)Vr
88	<i>Gyroidina soldanii</i>	2, (44,)Vr	—	—	2, (56,)Vr	—	1, (63,)Vr
89	<i>Hanzawaia nipponica</i>	3, (66,)R	—	4, (132,)Vr	1, (28,)Vr	—	1, (63,)Vr
90	<i>Haplophragmoides canariensis</i>	—	—	—	—	—	—
91	<i>H. spp.</i>	—	—	—	—	—	—
92	? <i>Haplophragmoides</i> sp.	—	—	—	—	—	—
93	<i>Hauerina brodyi</i>	1, (22,)Vr	—	—	—	—	—
94	<i>H. fragilissima</i>	—	—	—	—	1, (15,)Vr	1, (63,)Vr
95	<i>H. orientalis</i>	—	—	—	—	—	1, (63,)Vr
96	<i>H. pacifica</i>	1, (22,)Vr	—	—	—	—	2, (127,)Vr
97	<i>Heterostegina glutinata</i>	—	1, (2,)Vr	—	—	—	—
98	<i>Lagena chaesteri</i>	—	—	—	1, (28,)Vr	—	—
99	<i>L. laevis</i>	—	—	1, (33,)Vr	—	1, (15,)Vr	—
100	<i>L. perlucida</i>	—	—	—	1, 1(28, 28)Vr	—	—
101	<i>L. striata</i>	1, (22,)Vr	—	1, (33,)Vr	2, (56,)Vr	—	—
102	? <i>Laterostomella</i> sp.	—	—	—	3, (83,)Vr	—	—
103	<i>Lenticulina cf. cultratus</i>	—	—	—	2, (56,)Vr	1, (15,)Vr	—
104	<i>L. kamakuraensis</i>	—	1, (2,)Vr	—	—	—	—
105	<i>L. limbosus</i>	—	1, (2,)Vr	—	—	—	—
106	<i>L. sp.</i>	—	—	—	2, (56,)Vr	—	—
107	<i>Loxostomoides durandii</i>	—	—	—	2, (56,)Vr	—	1, (63,)Vr
108	<i>L. limbatum</i>	—	—	—	2, (56,)Vr	—	3, (190,)Vr
109	<i>Martinottiella bradyana</i>	—	—	—	—	—	—
110	<i>Massilina inaequalis</i>	—	—	1, (33,)Vr	3, (83,)Vr	4, (60,)R	1, (63,)Vr
111	<i>M. planata</i>	—	—	—	—	—	—
112	<i>M. sp. (new species from Noto)</i>	—	—	—	2, (56,)Vr	1, (15,)Vr	—
113	<i>M. sp.</i>	—	—	1, (33,)Vr	—	—	1, (63,)Vr
114	<i>Melonis nikobarensis</i>	—	—	1, (33,)Vr	1, (28,)Vr	2, (30,)Vr	—
115	<i>Mitilinaella circularis</i>	—	—	—	1, (28,)Vr	2, (30,)Vr	3, (190,)Vr
116	<i>M. oblonga</i>	1, (22,)Vr	—	12, (395,)R	5, (139,)Vr	—	—
117	<i>Neoconorbina stachi</i>	—	—	—	—	—	3, (190,)Vr
118	<i>N. terquemi</i>	2, (44,)Vr	—	1, (33,)Vr	—	—	4, (253,)Vr
119	<i>Nodosaria</i> sp.	—	—	—	—	—	2, (127,)Vr
120	<i>Nonion baueanum</i>	1, (22,)Vr	—	—	—	—	—
121	<i>N. japonicum</i>	—	—	—	—	3, (45,)R	4, (253,)Vr
122	<i>N. pacificum</i>	—	—	—	—	—	1, 1(63, 63)Vr
123	<i>Nonionella miocenica</i>	—	—	—	—	—	—
124	<i>N. pulchella</i>	—	—	5, (165,)R	5, (139,)Vr	—	—
125	<i>Nonionella labradrica</i>	1, (22,)Vr	—	2, (66,)Vr	8, (222,)R	—	—
126	<i>Nouria polymorphinoides</i>	—	—	—	—	—	—
127	<i>Nummulculina contraria</i>	—	1, (2,)Vr	—	—	—	—
128	<i>Operculina ammonoides</i>	7, 1(153, 22)R	1, (2,)Vr	4, (132,)Vr	1, (28,)Vr	—	—
129	<i>Paratotalia cf. imperatoria globosa</i>	—	—	1, (33,)Vr	—	—	—
130	<i>P. murrayi</i>	—	—	5, (165,)R	4, (111,)Vr	4, (60,)R	5, (316,)R
131	<i>P. ozawai</i>	—	—	1, (33,)Vr	—	2, (30,)Vr	—
132	<i>Patellina corrugata</i>	—	—	—	2, (56,)Vr	—	2, (127,)Vr
133	<i>Patellinella inconspicua</i>	—	—	2, (66,)Vr	—	—	—
134	<i>Peneroplites pertusus</i>	—	—	—	—	1, 1(15, 15)Vr	—
135	<i>Planispirinella exiqua</i>	—	—	—	—	—	3, (190,)Vr
136	<i>Planodiscorbis</i> sp.	—	—	2, (66,)Vr	—	—	—
137	<i>Planorbulina cf. mediterraneensis</i>	1, (22,)Vr	—	1, (33,)Vr	1, (28,)Vr	—	7, (443,)R
138	<i>Planulina subdepressa</i>	—	—	1, (33,)Vr	—	—	1, (63,)Vr

55	51	47	20	31	28	26	34	
—	—	2, (44,)Vr	6, (78,)R	—	5, 1(24, 5)R	1, (7,)Vr	—	70
1, (21,)Vr	—	—	—	—	—	—	—	71
—	—	—	—	—	—	—	—	72
—	—	—	—	—	—	—	—	73
—	—	—	—	—	—	—	—	74
—	—	—	—	—	—	—	—	75
—	—	—	—	—	—	—	—	76
4, (82,)R	1, (4,)Vr	15, (331,)F	14, (181,)R	—	2, (10,)Vr	—	—	77
—	—	—	5, (65,)Vr	—	—	—	—	78
—	—	2, (44,)Vr	2, (26,)Vr	—	—	—	—	79
—	—	—	—	—	—	—	—	80
2, (41,)Vr	2, (9,)R	9, (198,)R	7, (90,)R	—	—	—	1, (3,)Vr	81
—	—	2, (44,)Vr	—	—	—	—	—	82
—	—	—	3, (40,)Vr	—	—	—	—	83
—	—	—	—	—	—	—	—	84
—	—	—	—	—	—	—	—	85
—	—	—	—	—	—	—	—	86
2, (41,)Vr	1, (4,)Vr	—	1, (13,)Vr	1, (5,)Vr	—	1, (7,)Vr	—	87
—	—	—	—	—	—	—	—	88
—	1, (4,)Vr	—	—	—	—	—	—	89
—	—	4, (88,)R	—	—	—	—	3, 1(9, 3)Vr	90
7, (144,)R	—	—	—	—	—	—	—	91
—	—	—	1, (13,)Vr	—	—	8, 3(57, 2)R	—	92
—	—	1, (22,)Vr	2, (26,)Vr	—	—	—	—	93
—	1, (4,)Vr	1, (22,)Vr	1, (13,)Vr	—	—	—	—	94
—	—	1, (22,)Vr	—	—	—	—	—	95
—	1, (4,)Vr	2, (44,)Vr	—	—	—	—	—	96
—	—	—	—	—	—	—	—	97
—	—	—	—	—	—	—	—	98
—	—	—	—	—	—	—	—	99
—	—	—	—	—	—	—	—	100
—	—	—	1, (13,)Vr	—	1, (5,)Vr	—	—	101
—	—	—	—	—	—	—	—	102
—	—	—	1, 1(13, 13)Vr	—	—	—	—	103
—	—	—	—	—	—	—	—	104
—	—	—	—	—	—	—	—	105
—	—	1, (22,)Vr	—	—	—	—	—	106
—	—	1, (22,)Vr	—	—	—	—	—	107
1, (12,)Vr	1, (4,)Vr	—	3, (40,)Vr	—	—	—	—	108
—	—	—	3, (40,)Vr	—	—	—	—	109
—	—	—	—	—	—	—	—	110
5, (103,)R	2, (9,)Vr	7, 2(154, 44)R	5, (65,)Vr	—	1, (5,)Vr	—	—	111
4, (82,)R	1, (4,)Vr	—	5, (56,)Vr	—	—	—	—	112
—	—	—	2, (26,)Vr	—	—	—	—	113
—	1, (4,)Vr	1, (22,)Vr	—	—	—	—	—	114
2, (41,)Vr	—	—	3, (40,)Vr	—	—	—	—	115
—	—	—	20, (258,)R	—	—	—	—	116
—	—	—	3, (40,)Vr	6, (29,)R	2, (10,)Vr	6, (42,)R	—	117
—	—	—	—	—	—	—	—	118
—	1, (4,)Vr	1, (22,)Vr	—	—	—	—	—	119
—	—	—	—	—	—	—	—	120
—	2, (9,)Vr	—	—	—	—	—	—	121
1, (21,)Vr	—	—	1, 1(13, 13)Vr	—	—	—	—	122
—	—	—	—	—	—	—	—	123
3, (62,)Vr	—	—	9, 1(116, 13)R	3, 1(14, 5)R	5, 1(24, 5)R	7, 1(50, 7)R	—	124
—	—	—	—	—	—	—	—	125
2, (41,)Vr	—	—	1, (13,)Vr	—	—	—	—	126
—	—	—	—	—	—	—	—	127
—	—	—	—	—	—	—	—	128
—	—	—	—	—	—	—	—	129
9, (185,)F	1, (4,)Vr	—	1, (13,)Vr	7, (34,)R	1, (5,)Vr	—	—	130
3, (62,)R	—	6, (132,)R	10, (129,)R	1, (5,)Vr	—	1, (7,)Vr	—	131
—	1, (4,)Vr	1, (22,)Vr	—	—	1, 5,)Vr	—	—	132
—	—	1, (22,)Vr	—	—	—	—	—	133
—	—	—	—	—	—	—	—	134
—	—	—	1, (13,)Vr	—	—	—	—	135
—	—	—	—	—	—	—	—	136
—	—	—	—	—	—	—	—	137
—	—	5, (110,)R	1, (13,)Vr	—	—	—	—	138
—	—	—	—	1, (5,)Vr	—	—	—	

Table 3. (Continued)

Station No.		96	97	82	84	75	61
Species							
139 <i>Podolia</i> sp.	—	—	—	—	—	2, (30,)R	4, (253,)Vr
140 <i>Porosponides cribratopandus</i>	2, (44,)Vr	1, (2,)Vr	—	—	1, (28,)Vr	—	—
141 <i>Pseudorotalia gaimardii</i>	—	—	—	2, (66,)Vr	3, (83,)Vr	—	—
142 <i>Pyrgo denticulata</i>	2, (44,)Vr	1, (2,)Vr	—	—	—	—	6, (380,)R
143 <i>Quinqueloculina agglutinans</i>	—	—	—	1, (33,)Vr	—	6, (89,)R	—
144 <i>Q. agglutinata</i>	2, (44,)Vr	—	—	—	—	—	—
145 <i>Q. bicarinata</i>	4, (87,)R	1, (2,)Vr	—	—	—	—	—
146 <i>Q. bicornis</i>	1, (22,)Vr	—	—	—	—	2, (30,)R	1, (63,)Vr
147 <i>Q. bosciana</i>	—	—	—	5, (165,)R	—	—	—
148 <i>Q. bardyana</i>	3, (66,)R	—	—	2, (66,)Vr	7, (194,)R	4, (60,)R	14, (886,)R
149 <i>Q. candeiana</i>	5, (109,)R	—	—	2, (66,)Vr	—	—	—
150 <i>Q. contorta</i>	4, (87,)R	—	—	—	1, (28,)Vr	—	2, (127,)Vr
151 <i>Q. crassa</i>	1, (22,)R	1, (2,)Vr	—	—	—	—	—
152 <i>Q. elongata</i>	—	—	—	—	—	2, (30,)R	2, (127,)Vr
153 <i>Q. granulosa</i>	—	1, (2,)Vr	—	—	16, (444,)R	3, (45,)R	3, (190,)Vr
154 <i>Q. laevigata</i>	—	2, (4,)Vr	32, (1053,)F	13, (361,)R	—	—	29, (1836,)F
155 <i>Q. lamareckiana</i>	—	—	—	5, (139,)Vr	7, (105,)R	—	—
156 <i>Q. cf. lato</i>	—	—	—	2, (56,)Vr	—	—	—
157 <i>Q. limbata</i>	—	—	—	—	—	—	1, (63,)Vr
158 <i>Q. parkeri</i>	—	4, (8,)R	—	—	—	—	3, (190,)Vr
159 <i>Q. poeyana</i>	—	—	—	—	—	—	3, (190,)Vr
160 <i>Q. poeyana</i> var.	—	—	—	—	—	—	—
161 <i>Q. polygona</i>	—	—	—	—	2, (56,)Vr	—	—
162 <i>Q. reticulata</i>	—	8, (15,)R	1, (33,)Vr	—	—	—	—
163 <i>Q. seminulum</i>	3, (66,)R	1, (2,)Vr	3, (99,)Vr	1, (28,)Vr	2, (30,)R	—	—
164 <i>Q. subagglutinata</i>	—	2, (4,)Vr	—	—	—	—	2, (127,)Vr
165 <i>Q. sulcata</i>	—	—	—	—	—	—	3, (190,)Vr
166 <i>Q. vulgaris</i>	7, (153,)R	9, (17,)R	3, (99,)Vr	17, (472,)R	—	—	1, (63,)Vr
167 <i>Q. sp. A</i>	1, (22,)Vr	—	1, (33,)Vr	—	—	—	—
168 <i>Q. sp. B</i>	—	—	1, (33,)Vr	—	—	—	—
169 <i>Q. spp.</i>	2, (44,)Vr	3, (6,)Vr	3, (99,)Vr	7, (194,)R	7, (105,)R	18, (1139,)R	—
170 <i>Reophax bacillaris</i>	—	—	—	—	—	—	—
171 <i>R. cf. curtus</i>	—	—	1, (33,)Vr	—	—	—	—
172 <i>R. fusiformis</i>	—	—	—	—	—	—	—
173 <i>R. gracilis</i>	—	—	—	—	—	—	—
174 <i>R. sp.</i>	—	—	—	—	—	—	—
175 <i>Reussella aculeata</i>	5, (109,)R	1, (2,)Vr	—	6, (168,)R	4, (60,)R	7, (443,)R	—
176 <i>R. simplex</i>	—	—	—	—	1, (15,)Vr	—	—
177 <i>R. sp.</i>	—	—	—	4, (111,)Vr	—	—	—
178 <i>Rosalina bradyi</i>	—	3, (6,)Vr	—	—	—	—	—
179 <i>R. concinna</i>	1, (22,)Vr	—	5, (163,)R	—	—	—	2, (127,)Vr
180 <i>R. floridana</i>	4, (87,)R	—	17, (560,)R	29, (805,)F	—	—	25, (1583,)F
181 <i>R. globularis</i>	3, (66,)R	—	6, (198,)R	13, (361,)R	12, (179,)F	18, (1139,)R	—
182 <i>R. micans</i>	1, (22,)Vr	—	—	—	—	—	—
183 <i>R. rugosa</i>	—	—	6, (198,)R	—	—	—	—
184 <i>R. subbertheloti</i>	2, (44,)Vr	—	—	—	—	—	2, (127,)Vr
185 <i>R. vitardeboana</i>	6, (131,)R	—	5, (165,)R	—	—	—	1, (63,)Vr
186 <i>R. spp.</i>	—	—	2, (66,)R	6, (168,)R	10, (150,)F	5, (316,)R	—
187 <i>Saccammina</i> cf. <i>sphaerica</i>	—	—	—	—	—	—	—
188 <i>?Saccammina</i> sp.	—	—	—	1, (28,)Vr	—	—	—
189 <i>Schlumbergerina alveoliniformis</i>	—	—	—	1, (28,)Vr	1, (15,)Vr	—	—
190 <i>Scutularis</i> sp. A	7, (153,)R	1, (2,)Vr	4, (132,)R	7, (194,)R	2, (30,)R	22, (1393, 63)F	—
191 <i>Sigmavirgulina tortuosa</i>	1, (22,)Vr	—	—	2, (56,)Vr	—	—	1, (63,)Vr
192 <i>Sigmoilina</i> sp.	—	—	—	—	1, (15,)Vr	—	—
193 <i>Sigmoilopsis schlumbergeri</i>	—	—	—	10, (280,)R	6, (89,)R	—	—
194 <i>Siphogenerina virgula</i>	—	—	—	—	—	—	—
195 <i>Siphotextularia saulcyana</i>	—	—	1, (33,)Vr	—	—	—	1, (63,)Vr
196 <i>Sorites marginalis</i>	3, (66,)R	—	—	—	—	—	—
197 <i>Spirillina vivipara</i>	1, (22,)Vr	—	3, (99,)Vr	—	—	—	—
198 <i>Spiroloculina corrugata</i>	—	1, (2,)Vr	1, (33,)Vr	1, (28,)Vr	—	—	4, (253,)Vr
199 <i>S. cymbium</i>	—	—	1, (33,)Vr	—	—	—	—
200 <i>S. faeolata</i>	—	—	—	1, (28,)Vr	—	—	—
201 <i>S. lucida</i>	1, (22,)Vr	—	—	—	—	—	—
202 <i>S. cf. perforata</i>	—	—	—	—	—	—	—
203 <i>S. spp.</i>	—	—	—	—	—	—	1, (63,)Vr
204 <i>Spiroplectammina bifurcata</i>	—	—	—	—	1, (15,)Vr	—	—
205 <i>Textularia articulata</i>	5, (109, 22)R	—	—	—	—	—	—
206 <i>T. calva</i>	—	8, (15,)R	1, (33,)Vr	—	—	—	—
207 <i>T. candeiana</i>	3, (66,)R	—	3, (99,)Vr	—	—	—	14, (886,)R

55	51	47	20	31	28	26	34	
—	—	—	—	—	—	—	—	139
—	—	—	—	—	—	—	—	140
1, (21,)Vr	—	—	—	—	—	—	—	141
—	—	—	2, (26,)Vr	—	—	1, (7,)Vr	—	142
—	3, (13,)R	—	—	—	—	—	—	143
—	—	—	—	—	—	—	—	144
—	—	—	—	—	—	—	—	145
—	—	—	1, (13,)Vr	—	—	—	—	146
5, (103,)R	1, (4,)Vr	1, (22,)Vr	14, (181,)R	—	—	—	—	147
—	2, (9,)R	5, (110,)R	5, (65,)Vr	—	—	—	—	148
—	1, (4,)Vr	—	—	—	—	—	—	149
—	—	—	5, (65,)Vr	—	—	—	—	150
—	—	—	—	—	—	—	—	151
—	—	1, (22,)Vr	—	—	—	—	—	152
—	1, 1(4, 4)Vr	1, (22,)Vr	13, (168,)R	—	—	1, (7,)Vr	—	153
22, (453,)F	5, 2(22, 9)R	23, (507,)F	53, (685,)F	12, 1(58, 5)F	3, (14,)R	—	—	154
7, (144,)R	1, (4,)Vr	—	—	—	—	1, (7,)Vr	—	155
—	—	1, (22,)Vr	—	—	—	—	—	156
—	—	1, (22,)Vr	—	—	—	—	—	157
—	—	—	1, (13,)Vr	—	—	—	—	158
—	—	—	—	1, (5,)Vr	—	—	—	159
—	—	1, (22,)Vr	1, (13,)Vr	—	—	—	—	160
—	—	—	—	—	—	—	—	161
—	3, (13,)R	1, (22,)Vr	3, (40,)Vr	1, (5,)Vr	11, 2(52, 10)F	1, (7,)Vr	—	162
—	—	—	—	—	—	—	—	163
—	—	1, (22,)Vr	5, (65,)Vr	—	—	—	—	164
—	—	6, (132,)R	1, (13,)Vr	4, (19,)R	—	1, (7,)Vr	—	165
4, (82,)R	4, (18,)R	—	—	—	—	—	—	166
—	—	—	—	—	—	—	—	167
—	—	—	—	—	—	—	—	168
—	6, (26,)F	19, (418,)F	20, (258,)R	5, 2(24, 10)R	4, (19,)R	3, (21,)R	—	169
—	—	—	—	—	—	—	1, 1(3, 3)Vr	170
—	—	—	—	—	—	—	—	171
—	—	2, (44,)Vr	—	—	1, (5,)Vr	—	—	172
—	—	—	—	1, 1(5, 5)Vr	1, (5,)Vr	—	2, (6,)Vr	173
—	—	—	—	—	—	—	6, (18,)R	174
3, (62,)R	—	7, 1(154, 22)R	15, (194,)R	—	—	—	—	175
—	—	—	—	—	—	—	1, (3,)Vr	176
—	—	—	—	—	—	—	—	177
—	—	—	—	—	—	—	—	178
—	1, (4,)Vr	3, (66,)Vr	1, (13,)Vr	—	—	—	—	179
6, (124,)R	—	—	10, (129,)R	—	1, (5,)Vr	—	—	180
3, (62,)R	1, (4,)Vr	4, (88,)R	29, (375,)F	1, (5,)Vr	—	3, (21,)R	—	181
—	—	2, (44,)Vr	—	—	—	—	—	182
—	—	3, (66,)Vr	—	—	—	—	—	183
2, (42,)Vr	1, (4,)Vr	—	—	—	—	—	—	184
1, (21,)Vr	—	2, (44,)Vr	—	3, (14,)R	—	—	—	185
—	—	—	3, (40,)Vr	—	1, (5,)Vr	1, (7,)Vr	1, (3,)Vr	186
—	—	1, (22,)Vr	—	—	—	—	—	187
1, (21,)Vr	—	—	—	—	—	—	—	188
—	—	—	—	—	—	—	—	189
—	—	11, (253,)R	22, (283,)R	1, (5,)Vr	—	—	—	190
—	—	1, (22,)Vr	—	—	—	—	—	191
—	1, (4,)Vr	—	1, (13,)Vr	—	—	—	—	192
1, (21,)Vr	2, (9,)R	2, (44,)Vr	13, (168,)R	5, 1(24, 5)R	11, 1(52, 5)F	15, (107,)F	—	193
—	—	—	4, (52,)Vr	—	—	—	—	194
—	—	—	5, (65,)Vr	—	—	—	—	195
—	—	—	—	—	—	—	—	196
—	—	—	—	—	—	—	—	197
—	—	2, (44,)Vr	1, (13,)Vr	—	—	—	—	198
—	—	—	—	—	—	—	—	199
—	—	—	—	—	—	—	—	200
—	—	1, (22,)Vr	1, (13,)Vr	—	—	—	—	201
—	—	—	2, (26,)Vr	—	—	—	—	202
1, (21,)Vr	—	—	—	—	—	—	—	203
—	—	—	—	—	—	—	—	204
—	—	6, (132,)R	—	—	—	4, (28,)R	4, 3(12, 9)R	205
—	—	—	—	—	—	—	—	206
—	—	—	—	—	—	—	—	207
—	—	5, (110,)R	1, (13,)Vr	—	—	—	—	

Table 3. (Continued)

Station No.		96	97	82	84	75	61
Species							
208 <i>T. conica</i>	3, (66,)R	—	—	6, (198,)R	14, (389,)R	—	3, (190,)Vr
209 <i>T. cracentiformis</i>	—	—	—	—	—	—	—
210 <i>T. cf. earlandi</i>	—	—	—	—	2, (56,)Vr	—	1, (63,)Vr
211 <i>T. foliacea</i>	1, (22,)Vr	—	—	—	2, (56,)Vr	—	1, (63,)Vr
212 <i>T. kerimbaensis</i>	1, (22,)Vr	—	—	8, (263,)R	11, (305,)R	—	6, (380,)R
213 <i>T. orbica</i>	—	—	—	—	—	—	—
214 <i>T. pseudogramen</i>	1, (22,)Vr	3, (6,)Vr	1, (33,)Vr	—	—	—	—
215 <i>T. seacensis</i>	1, (22,)Vr	4, (8,)R	—	—	6, (89,)Vr	5, (316,)R	—
216 <i>T. vola</i>	—	—	1, (33,)Vr	—	—	—	—
217 <i>T. spp.</i>	2, (44,)Vr	—	1, (33,)Vr	—	—	1, (63,)Vr	—
218 <i>Tretomphalus</i> sp.	—	—	2, (66,)Vr	—	—	1, (63,)Vr	—
219 <i>Trifarina</i> sp.	—	—	1, (33,)Vr	—	—	—	—
220 <i>Triloculina affinis</i>	1, (22,)Vr	—	5, (165,)R	3, (83,)Vr	4, (60,)R	5, (316,)R	—
221 <i>T. bertheliniana</i>	—	2, (4,)Vr	—	—	—	—	—
222 <i>T. cf. cuneata</i>	—	1, (2,)Vr	—	—	—	—	—
223 <i>T. irregularis</i>	—	—	—	—	—	—	3, (190,)Vr
224 <i>T. oblonga</i>	—	—	—	—	1, (28,)Vr	—	—
225 <i>T. planclana</i>	—	—	6, (198,)R	—	—	—	4, (253,)Vr
226 <i>T. tricarinata</i>	—	—	1, (33,)Vr	2, (56,)Vr	3, (45,)R	2, (127,)Vr	—
227 <i>T. trigonula</i>	3, (66,)R	3, (6,)Vr	9, (296,)R	1, (28,)Vr	—	—	—
228 <i>T. subangularis</i>	—	—	—	—	1, (15,)Vr	—	—
229 <i>T. spp.</i>	2, (44,)Vr	—	1, (33,)Vr	2, (56,)Vr	—	1, (63,)Vr	—
230 <i>Trochammina globigeriniformis</i>	2, (44,)Vr	—	4, (132,)R	2, (56,)Vr	—	—	—
231 <i>T. inflata</i>	—	—	—	—	—	—	—
232 <i>T. nana</i>	1, (22,)Vr	—	—	—	—	—	—
233 <i>T. cf. pacifica simplex</i>	1, (22,)Vr	—	—	—	3, (45,)R	—	—
234 <i>T. spp.</i>	—	—	—	—	—	—	—
235 <i>Uvigerina proboscidea</i>	1, (22,)Vr	—	4, (132,)R	2, (56,)Vr	—	3, (190,)Vr	—
236 <i>U. cf. canariensis</i>	—	—	—	—	—	—	—
237 <i>Verbeulina striata</i>	1, (22,)Vr	—	—	—	—	4, (253,)Vr	—
238 <i>Wiesnerella suriculata</i>	—	—	2, (66,)Vr	6, (168,)R	—	—	—
239 MISCELLANEOUS	10, (219,)R	3, (6,)Vr	15, (494,)R	18, (500,)R	6, (89,)R	12, (759,)R	—
TOTAL BENTHONIC FORAMINIFERA		291, 3(6374, 66)	359, (677,)	433, 1(14270, 33)	518, 5(14415, 140)	208, 12(3110, 180)	477, 2(30188, 126)

PLANKTONIC FORAMINIFERA

Station No.		96	97	82	84	75	61
Species							
1 <i>Globigerina bulloides</i>	10, (219,)	—	—	4, 1(132, 33)	5, (139,)	—	10, 1(633, 63)
2 <i>G. quinqueloba</i>	—	—	—	14, 2(461, 66)	4, (111,)	—	—
3 <i>G. sp.</i>	—	—	—	—	1, (28,)	—	—
4 <i>Globigerinita glutinata</i>	1, 1(22, 22)	—	—	16, (527,)	1, (28,)	—	—
5 ? <i>Globigerinita</i> sp.	—	—	—	—	—	—	—
6 <i>Globigerinoides triloba immatura</i>	—	—	2, (66,)	—	—	—	5, (316,)
7 <i>G. triloba triloba</i>	—	1, (2,)	—	—	1, (15,)	—	—
8 <i>G. sp.</i>	—	—	1, (33,)	1, (28,)	—	—	—
9 <i>Globorotalia inflata</i>	—	—	1, (33,)	1, (28,)	—	—	—
10 <i>G. menadii</i>	—	—	—	—	—	—	—
11 <i>G. hirsuta</i>	1, (22,)	—	—	—	—	—	—
12 <i>G. pumilio</i>	—	—	—	—	—	—	—
13 <i>Globorotaloides cf. variabilis</i>	1, (22,)	—	1, (33,)	—	—	—	1, (63,)
14 <i>Hastigerina siphonifera</i>	—	—	6, (198,)	4, (111,)	—	—	1, (63,)
15 <i>Pulleriatina obliqueloculata</i>	—	1, (2,)	—	—	1, (15,)	—	—
16 MISCELLANEOUS	—	—	1, (33,)	—	—	—	—
TOTAL PLANKTONIC FORAMINIFERA		13, 1(285, 22)	2, (4,)	46, 3(1516, 99)	17, (473,)	2, (30,)	17, 1(1075, 63)

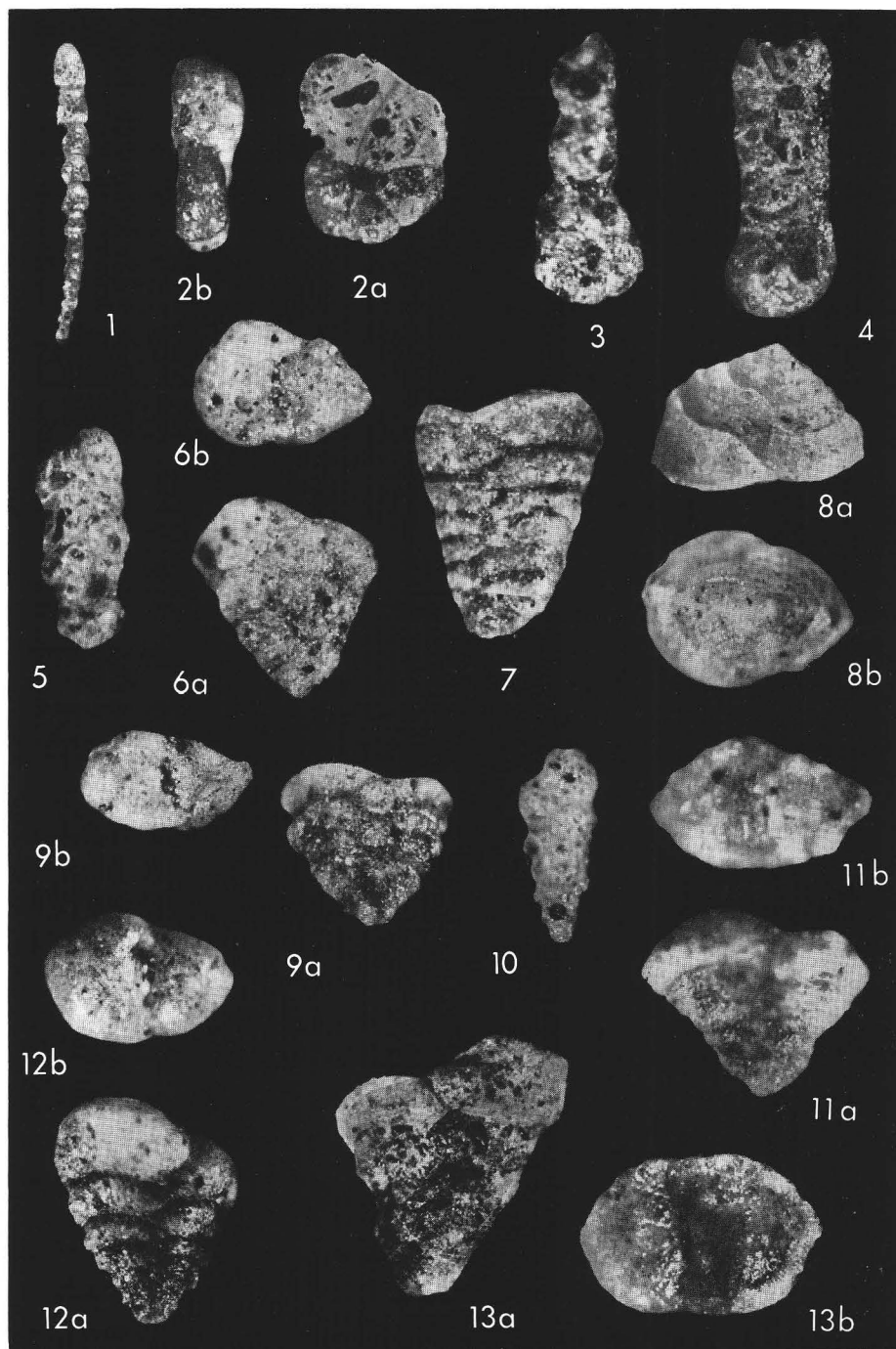
55	51	47	20	31	28	26	34	
—	—	5, (110,)R	5, (65,)Vr	—	—	—	—	208
—	—	—	1, (13,)Vr	2, 1(10, 5)R	—	—	2, (6,)Vr	209
—	—	—	—	3, (14,)R	1, (5,)Vr	3, (21,)R	8, 2(24, 6)F	210
—	3, (13,)R	4, (88,)R	1, (13,)Vr	—	—	—	—	211
—	—	3, (66,)Vr	6, (78,)R	—	—	—	—	212
—	1, (4,)Vr	1, (22,)Vr	3, (40,)Vr	—	—	—	—	213
—	—	—	—	—	—	—	—	214
—	—	3, (66,)Vr	—	—	—	—	—	215
—	—	—	—	—	—	—	—	216
—	—	3, (66,)Vr	—	—	—	—	—	217
—	—	—	3, (40,)Vr	—	—	—	—	218
—	—	—	—	—	—	—	—	219
—	1, (4,)Vr	2, (44,)Vr	4, (52,)Vr	—	—	—	—	220
—	—	—	—	—	—	—	—	221
—	—	—	—	—	—	—	—	222
—	—	—	—	—	—	1, (7,)Vr	—	223
—	—	—	10, (129,)R	—	—	—	—	224
—	—	—	1, (13,)Vr	—	—	—	—	225
2, (42,)Vr	—	—	3, (40,)Vr	—	—	—	—	226
—	2, (9,)R	—	—	1, (5,)Vr	—	1, (7,)Vr	—	227
—	—	—	—	—	—	—	—	228
—	—	—	1, (13,)Vr	—	—	—	—	229
2, (42,)Vr	9, 2(40, 9)F	5, (110,)R	2, (26,)Vr	13, (63,)F	18, (85,)F	19, 6(135, 43)F	48, (141,)A	230
—	—	—	—	—	—	—	4, (12,)R	231
—	1, 1(4, 4)Vr	1, (22,)Vr	1, (13,)Vr	—	—	—	—	232
—	5, (22,)R	1, (22,)Vr	10, 2(129, 26)R	8, (38,)R	—	—	—	233
—	—	—	3, (40,)Vr	—	6, (28,)R	—	—	234
—	—	—	1, (13,)Vr	—	—	—	—	235
—	—	1, (22,)Vr	1, (13,)Vr	—	7, (33,)R	5, (36,)R	—	236
—	—	—	2, (26,)Vr	—	—	—	—	237
—	—	2, (44,)Vr	—	—	—	—	—	238
5, (103,)R	3, (13,)R	5, (110,)R	15, (194,)R	3, (15,)R	1, (5,)Vr	3, (21,)R	—	239
220, 2(4336, 42)	145, 12(629, 55)	296, 5(6515, 110)	574, 8(7405, 104)	187, 12(902, 59)	249, 40(1188, 192)	239, 36(1693, 256)	191, 47(564, 139)	

55	51	47	20	31	28	26	34	
5, (103,)	—	—	—	—	—	3, (21,)	—	1
—	1, (4,)	—	6, 1(78, 13)	—	—	—	—	2
1, (21,)	—	—	—	—	—	—	—	3
1, (21,)	—	—	—	—	—	—	—	4
—	—	—	—	—	2, (10,)	—	—	5
—	—	—	—	—	—	1, (7,)	—	6
—	1, (4,)	1, (22,)	—	1, (5,)	—	—	—	7
—	—	—	—	—	—	—	—	8
—	—	—	—	—	—	—	—	9
—	—	—	1, (13,)	—	—	—	—	10
—	—	—	—	—	—	—	—	11
1, (21,)	—	—	—	—	—	—	—	12
—	—	—	—	—	—	—	—	14
2, (42,)	—	—	1, (13,)	—	1, (5,)	—	—	13
—	—	—	—	—	—	—	—	15
1, (21,)	—	—	—	—	—	—	—	16
11, (229,)	2, (8,)	1, (22,)	8, 1(104, 13)	1, (5,)	3, (15,)	4, (28,)	0, (0,)	

The numbers show the number of specimens counted in the actually examined fraction of respective samples, those in parentheses are the number of specimens estimated in the 20 g aliquot of respective samples, the numbers in italic concern the living, stained specimens. The frequency at each station is expressed in the following grades; VA: >46%, A: 46–22%, C: 22–10%, F: 10–4%, R: 4–1%, Vr: <1%.

PLATE VI

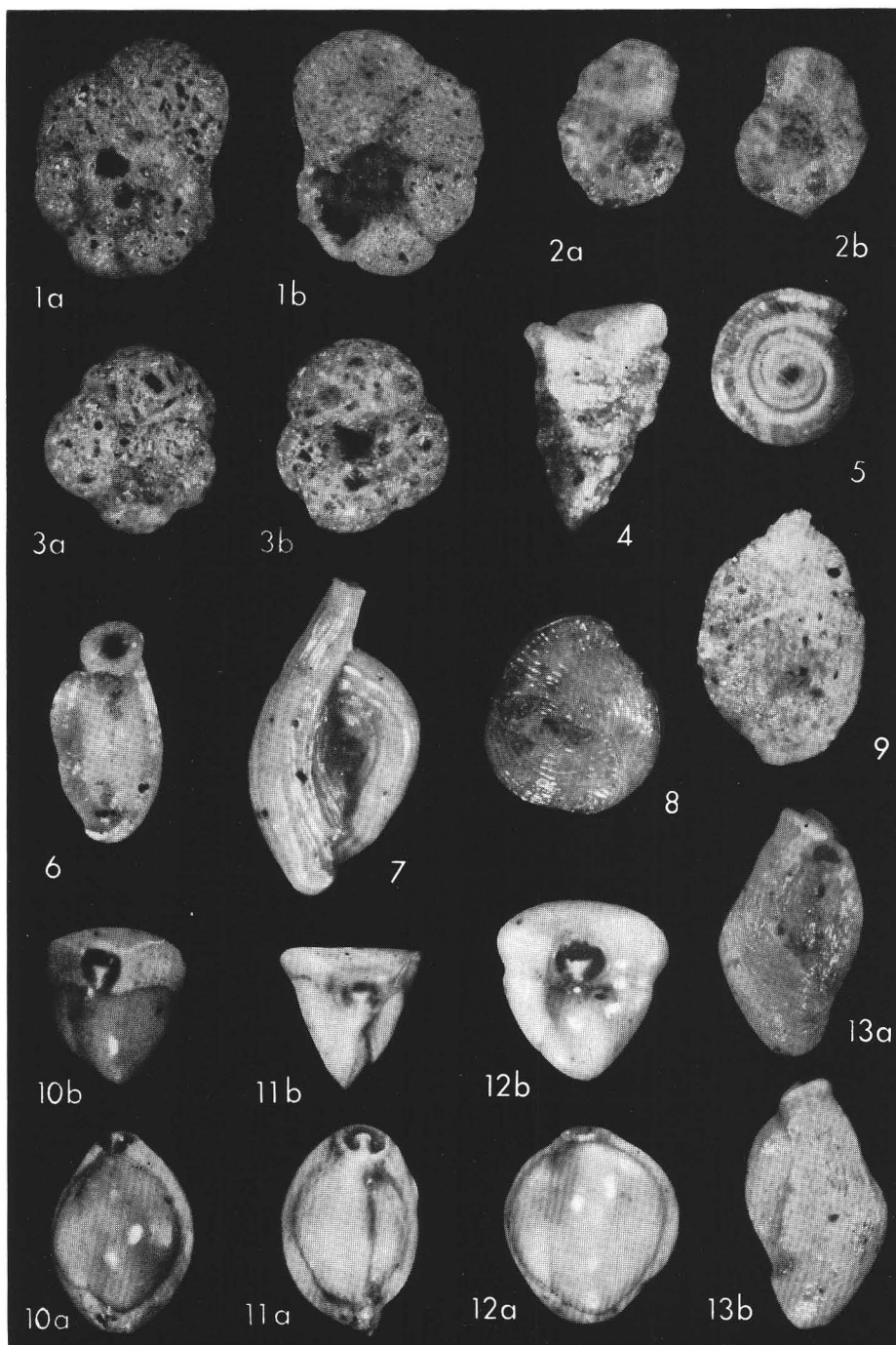
- 1: *Reophax gracilis* (KIAER), OMNH Reg. No. F10715F, $\times 80$
- 2a, b: *Cribrostomoides columbiense* (CUSHMAN), OMNH Reg. No. F10642F, $\times 80$
- 3: *Ammobaculites agglutinans* (D'ORBIGNY), OMNH Reg. No. F10617F, $\times 80$
- 4: *Ammomarginulina foliaceus* (BRADY), OMNH Reg. No. F10618F, $\times 80$
- 5: *Spiroplectammina biformis* (PARKER & JONES), MNHO Reg. No. F10728F, $\times 80$
- 6a, b: *Textularia secasensis* LALICKER & McCULLOCH, OMNH Reg. No. F10736F, $\times 80$
- 7: *T. pseudogramen* CHAPMAN & PARR, OMNH Reg. No. F10735F, $\times 50$
- 8a, b: *T. conica* D'ORBIGNY, OMNH Reg. No. F10732F, $\times 40$
- 9a, b: *T. kerimbaensis* SAID, OMNH Reg. No. F10734F, $\times 60$
- 10: *T. cf. earlandii* PARKER, OMNH Reg. No. F10733F, $\times 120$
- 11a, b: *T. candeiana* D'ORBIGNY, OMNH Reg. No. F10731F, $\times 80$
- 12a, b: *T. articulata* D'ORBIGNY, OMNH Reg. No. F10729F, $\times 60$
- 13a, b: *T. calva* LALICKER, OMNH Reg. No. F10730F, $\times 35$



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE VII

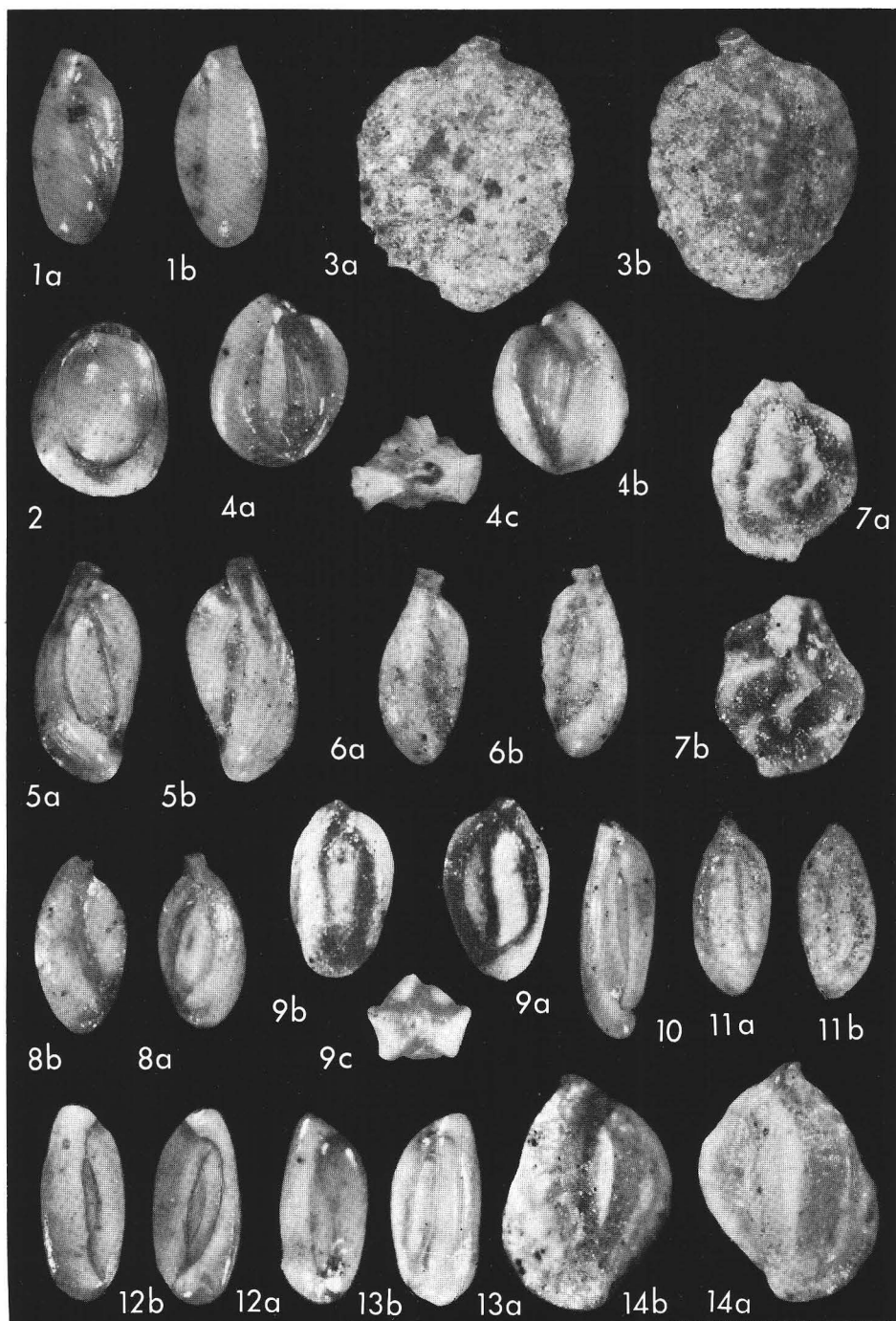
- 1a, b: *Trochammina inflata* (MONTAGU), OMNH Reg. No. F10743F, $\times 80$
2a, b: *T. pacifica simplex* CUSHMAN & McCULLOCH, OMNH Reg. No. F10744F,
 $\times 120$
3a, b: *T. globigeriniformis* (PARKER & JONES), OMNH Reg. No. F10742F, $\times 80$
4: *Gaudryina robusta* CUSHMAN, OMNH Reg. No. F10660F. $\times 60$
5: *Cyclogyra involvens* (REUSS), OMNH Reg. No. F10643F, $\times 100$
6: *Wiesnerella auriculata* (EGGER), OMNH Reg. No. F10747F, $\times 100$
7: *Spiroloculina corrugata* CUSHMAN & TODD, OMNH Reg. No. F10727F, $\times 80$
8: *Vertebralina striata* D'ORBIGNY, OMNH Reg. No. F10746F, $\times 80$
9: *Sigmoilopsis schlumbergeri* (SILVESTRI), OMNH Reg. No. 10726F, $\times 80$
10a, b: *Triloculina affinis* D'ORBIGNY, OMNH Reg. No. F10737F, $\times 60$
11a, b: *T. tricarinata* D'ORBIGNY, OMNH Reg. No. F10740F, $\times 80$
12a, b: *T. trigonula* (LAMARCK), OMNH Reg. No. F10741F, $\times 60$
13a, b: *T. planciana* D'ORBIGNY, OMNH Reg. No. F10739F, $\times 60$



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE VIII

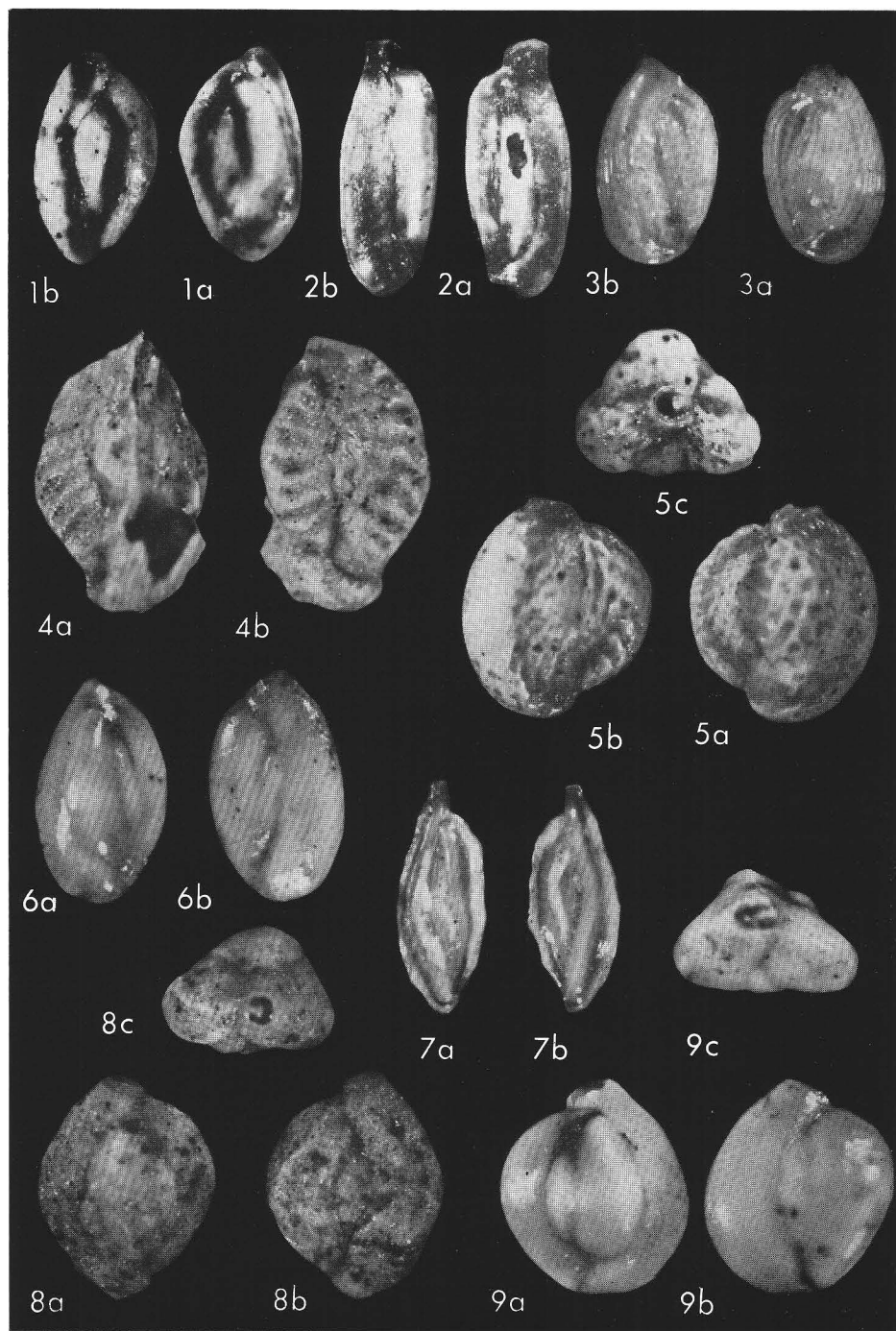
- 1a, b: *Triloculina oblonga* (MONTAGU), OMNH Reg. No. F10738F, $\times 80$
2: *Pyrgo denticulata* (BRADY), OMNH Reg. No. F10692F, $\times 55$
3a, b: *Quinqueloculina agglutinans* D'ORBIGNY, OMNH Reg. No. F10693F, $\times 35$
4a, b, c: *Q. bicarinata* D'ORBIGNY, OMNH Reg. No. F10694F, $\times 100$
5a, b: *Q. bicornis* (WALKER & JACOB), OMNH Reg. No. F10695F, $\times 80$
6a, b: *Q. bociana* D'ORBIGNY, OMNH Reg. No. F10696F, $\times 80$
7a, b: *Q. bradyana* CUSHMAN, OMNH Reg. No. F10697F, $\times 80$
8a, b: *Q. candeiana* D'ORBIGNY, OMNH Reg. No. F10698F, $\times 100$
9a, b, c: *Q. contorta* D'ORBIGNY, OMNH Reg. No. F10699F, $\times 80$
10: *Q. elongata* NATLAND, OMNH Reg. No. F10700F, $\times 55$
11a, b: *Q. granulosa* NATLAND, OMNH Reg. No. F10701F, $\times 120$
12a, b: *Q. laevigata* D'ORBIGNY, OMNH Reg. No. F10704F, $\times 120$
13a, b: *Q. laevigata* D'ORBIGNY, OMNH Reg. No. F10705F, $\times 120$
14a, b: *Q. lamarckiana* D'ORBIGNY, OMNH Reg. No. F10703F, $\times 80$



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE IX

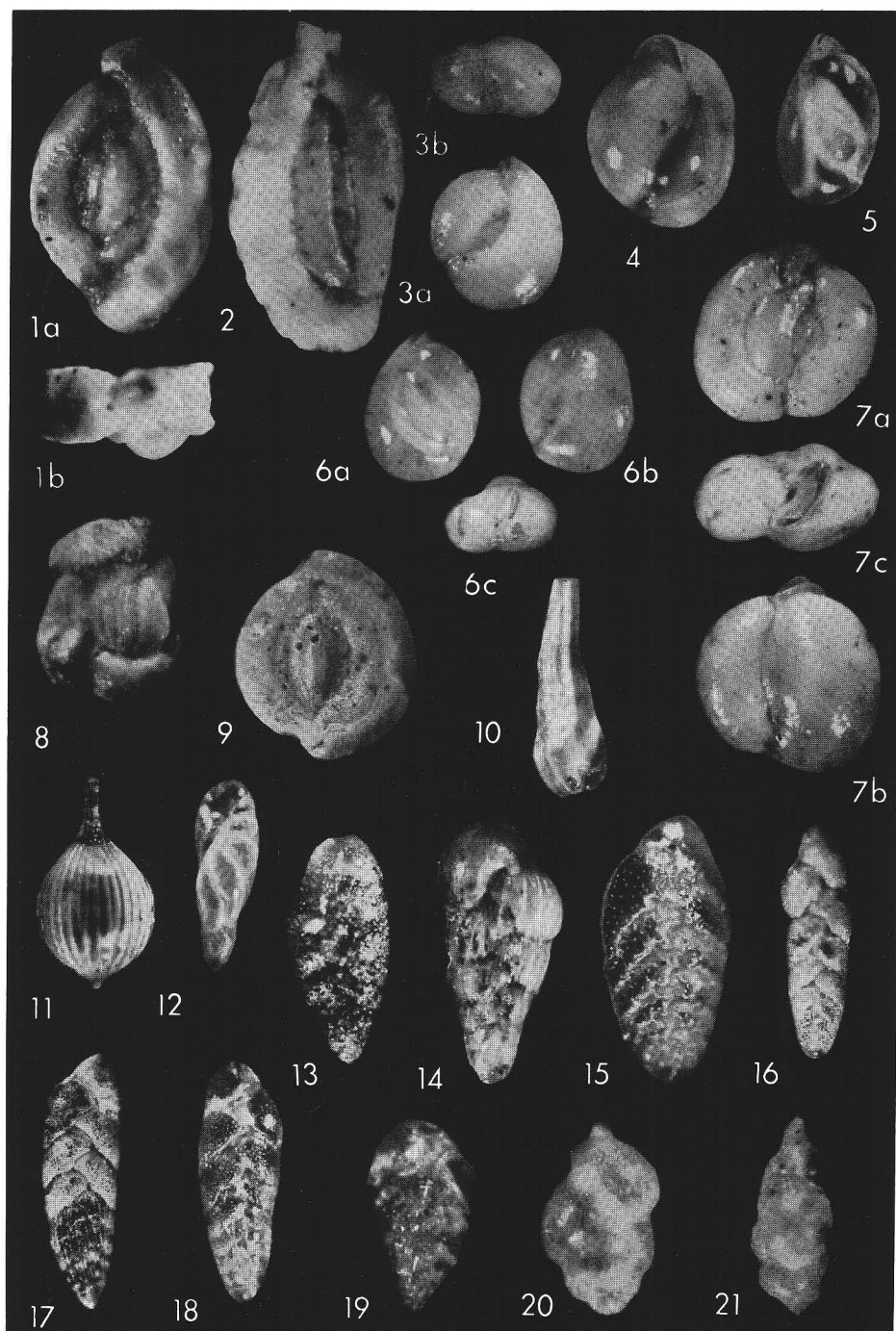
- 1a, b: *Quinqueloculina* cf. *lata* TERQUEM, OMNH Reg. No. F10706F, $\times 60$
2a, b: *Q. limbata* D'ORBIGNY, OMNH Reg. No. F10707F, $\times 50$
3a, b: *Q. poeyana* D'ORBIGNY, OMNH Reg. No. F10709F, $\times 120$
4a, b: *Q. parkeri* (BRADY), OMNH Reg. No. F10708F, $\times 40$
5a, b, c: *Q. reticulata* (D'ORBIGNY), OMNH Reg. No. F10710F, $\times 50$
6a, b: *Q. seminulum* (LINNÉ), OMNH Reg. No. F10711F, $\times 120$
7a, b: *Q. sulcata* D'ORBIGNY, OMNH Reg. No. F10713F, $\times 80$
8a, b: *Q. subagglutinata* ASANO, OMNH Reg. No. F10712F, $\times 36$
9a, b, c: *Q. vulgaris* D'ORBIGNY, OMNH Reg. No. F10714F, $\times 60$



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE X

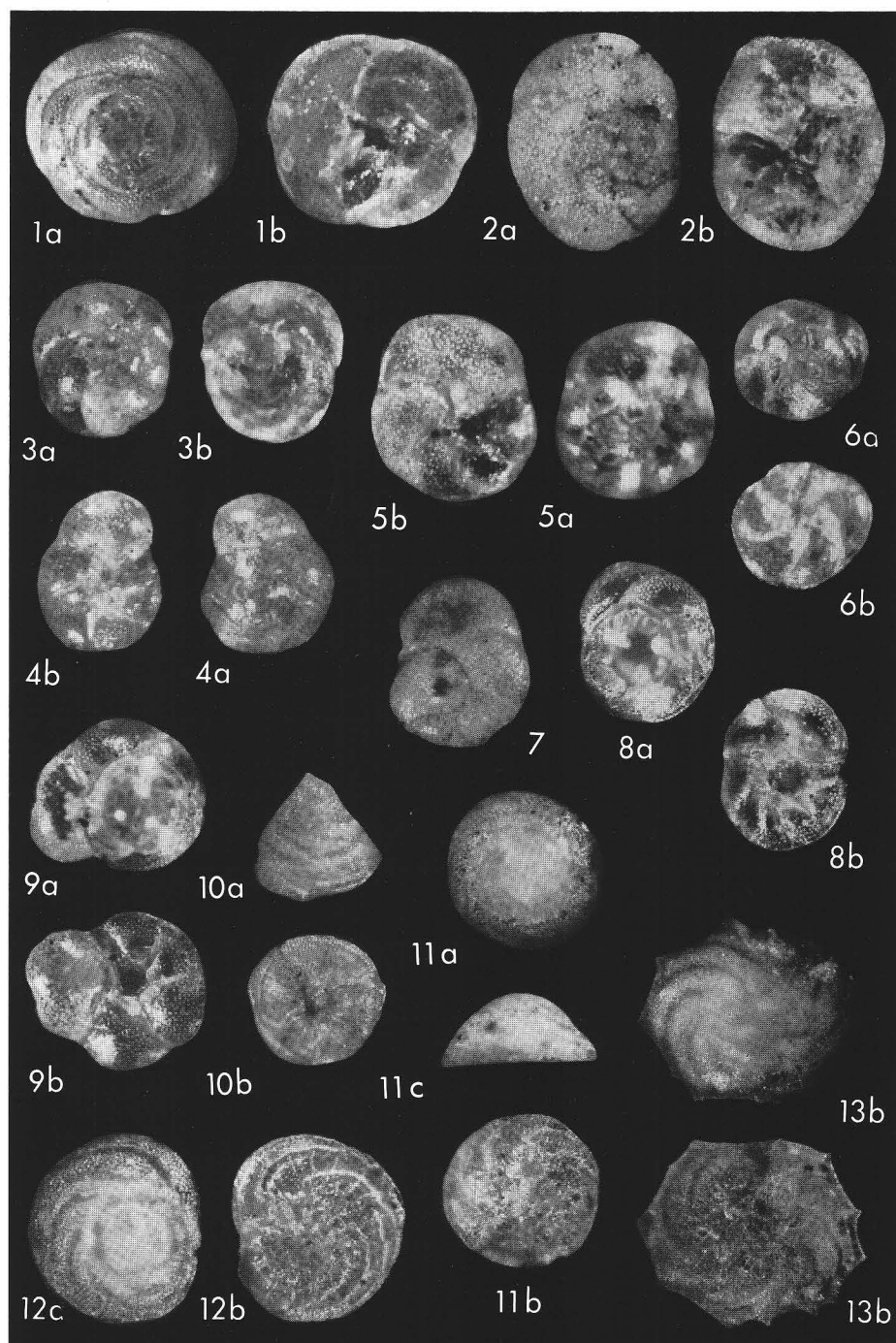
- 1a, b: *Massilina inaequalis* CUSHMAN, OMNH Reg. No. F10674F, ×80
- 2: *M. planata* CUSHMAN, OMNH Reg. No. F10675F, ×80
- 3a, b: *Miliolinella circularis* (BORENEMANN), OMNH Reg. No. F10679F, ×80
- 4: *M. circularis* (BORENEMANN), OMNH Reg. No. F10677F, ×60
- 5: *M. oblonga* (MONTAGU), OMNH Reg. No. F10678F, ×120
- 6a, b, c: *Scutuloris* sp. A, OMNH Reg. No. F10723F, ×80
- 7a, b, c: *S.* sp. A, OMNH Reg. No. F10724F, ×50
- 8: *Hauerina pacifica* CUSHMAN, OMNH Reg. No. F10671F, ×105
- 9: *H. fragilissima* (BRADY), OMNH Reg. F10670F, ×65
- 10: *Articulina conico-articulata* BATCH, OMNH Reg. No. F10625F, ×105
- 11: *Lagena striata* (D'ORBIGNY), OMNH Reg. No. F10657F, ×105
- 12: *Buliminella elegantissima* D'ORBIGNY, OMNH Reg. No. F10635F, ×105
- 13: *Bolivina glutinata* EGGER, OMNH Reg. No. F10627F, ×105
- 14: *B. subangularis* BRADY, OMNH Reg. No. F10629F, ×65
- 15: *B. robusta* BRADY, OMNH Reg. No. F10628F, ×80
- 16: *Brizalina seminuda* (CUSHMAN), OMNH Reg. No. F10632F, ×65
- 17: *B. striatula* (CUSHMAN), OMNH Reg. No. F10633F, ×80
- 18: *B. striatula* (CUSHMAN), OMNH Reg. No. F10634F, ×100
- 19: *Reussella sculeata* CUSHMAN, OMNH Reg. No. F10716F, ×80
- 20: *Uvigerina proboscidea* SCHWAGER, OMNH Reg. No. F10745-1F, ×120
- 21: *U. proboscidea* SCHWAGER, OMNH Reg. No. F10745-2F, ×120



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE XI

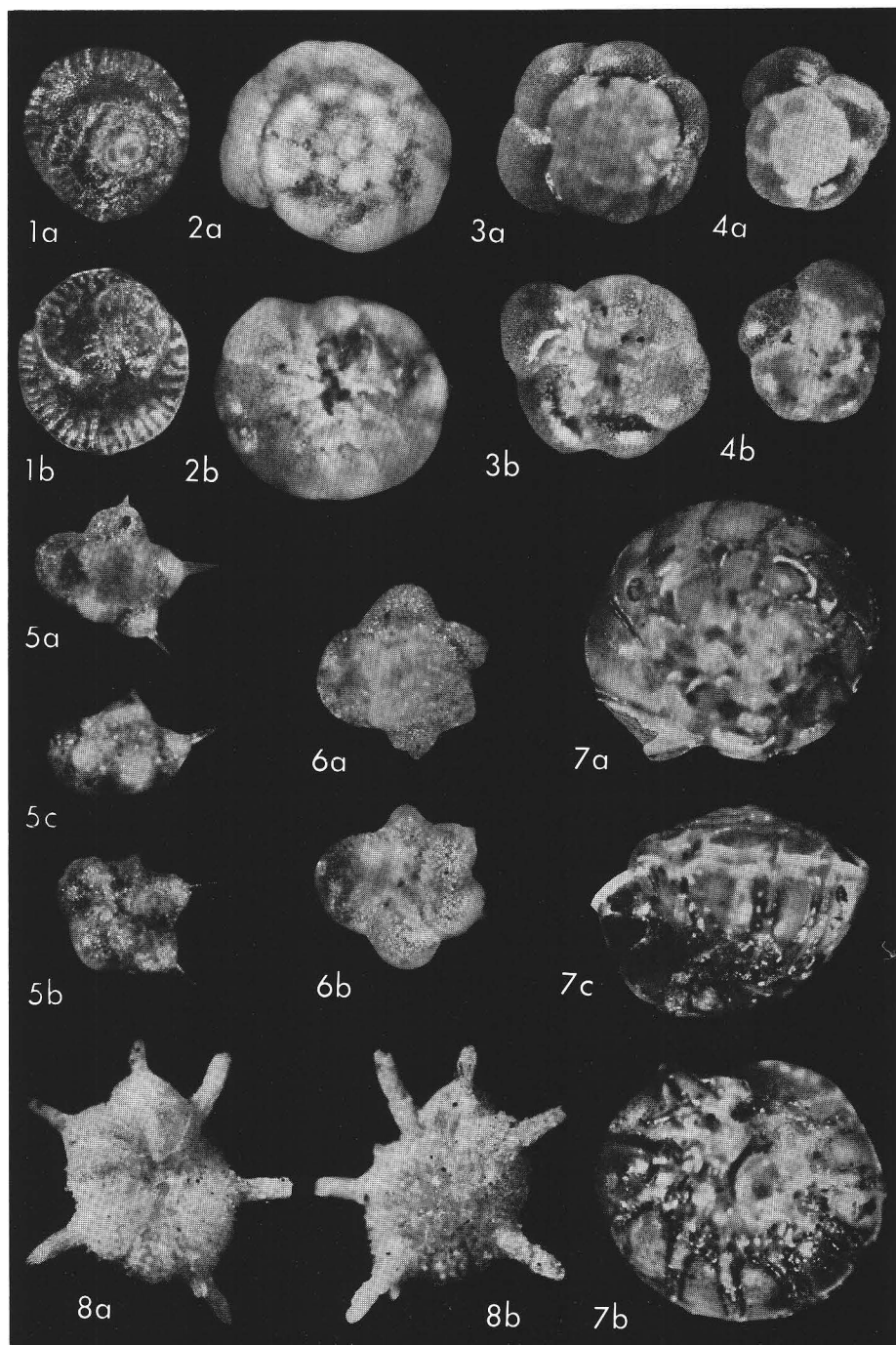
- 1a, b: *Neoconorbina terquemi* (RZEHAKE), OMNH Reg. No. F10680F, $\times 80$
2a, b: *Rosalina globularis* D'ORBIGNY, OMNH Reg. No. F10720F, $\times 60$
3a, b: *R. concinna* (BRADY), OMNH Reg. No. F10718F, $\times 100$
4a, b: *R. rugosa* D'ORBIGNY, OMNH Reg. No. F10721F, $\times 100$
5a, b: *R. floridana* (CUSHMAN), OMNH Reg. No. F10717F, $\times 100$
6a, b: *R. vilardeboana* D'ORBIGNY, OMNH Reg. No. F10722F, $\times 100$
7: *R. subbertheloti* CUSHMAN, OMNH Reg. No. F10719F, $\times 100$
8a, b: *Gavelinopsis* cf. *praegeri* (HERON-ALLEN & EARLAND), OMNH Reg. No. F10662F, $\times 80$
9a, b: *G.* cf. *praegeri* (HERON-ALLEN & EARLAND), OMNH Reg. No. F10661F, $\times 80$
10a, b: *Glabratella patelliformis* (BRADY), OMNH Reg. No. F10665F, $\times 80$
11a, b: *G. australensis* (HERON-ALLEN & EARLAND), OMNH Reg. No. F10663F, $\times 105$
12a, b: *G. opercularis* (D'ORBIGNY), OMNH Reg. No. F10664F, $\times 105$
13a, b: *G. opercularis nakamurai* ASANO, OMNH Reg. No. F10648F, $\times 80$



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE XII

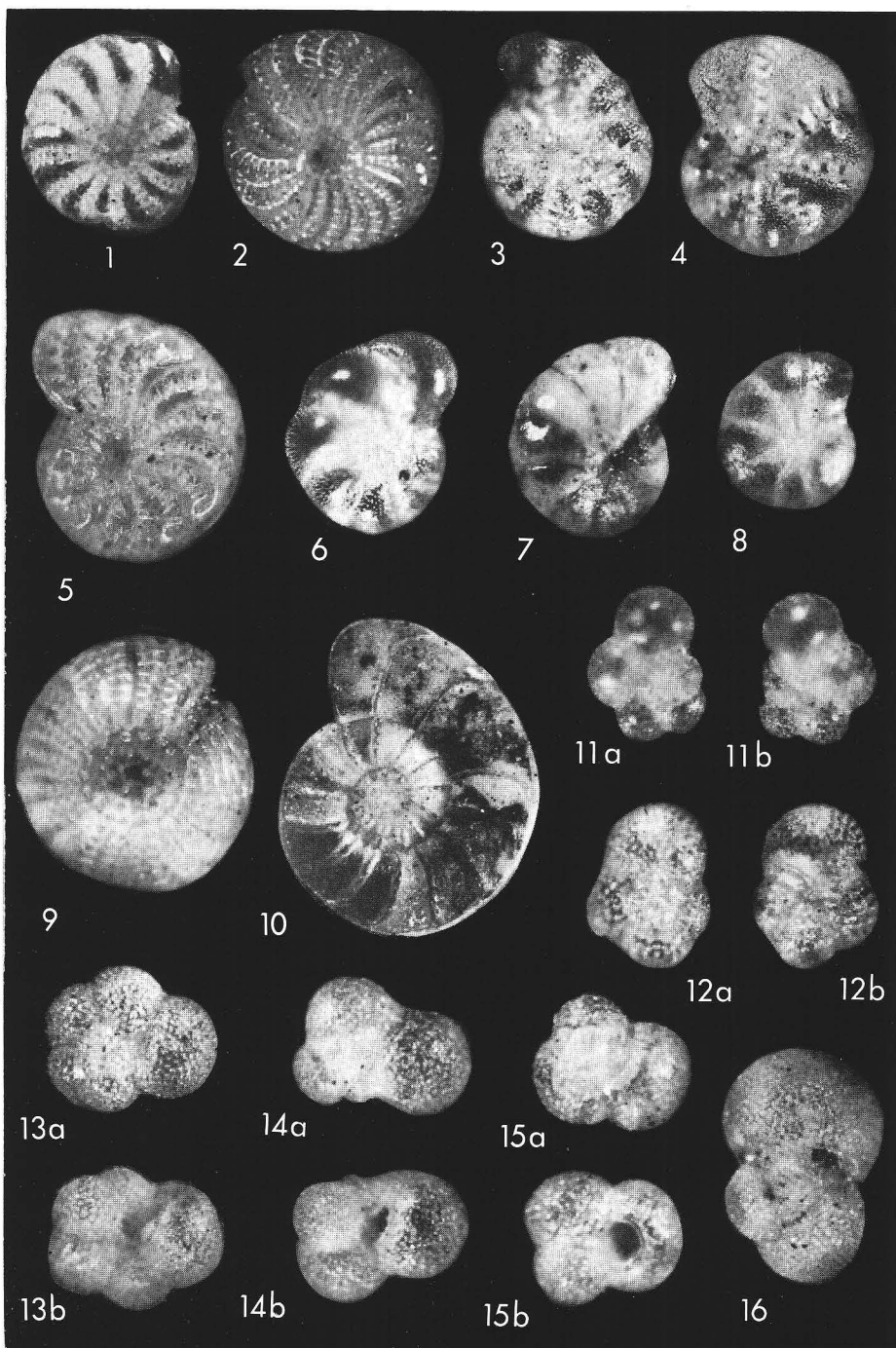
- 1a, b: *Patellina corrugata* WILLIAMSON, OMNH Reg. No. F10689F, $\times 100$
2a, b: *Ammonia beccarii* (LINNÉ) "forma A", OMNH Reg. No. F10621F, $\times 100$
3a, b: *A. beccarii tepida* (CUSHMAN), OMNH Reg. No. F10620F, $\times 135$
4a, b: *A. beccarii tepida* (CUSHMAN), OMNH Reg. No. F10619F, $\times 135$
5a, b, c: *Pararotalia* cf. *imperatoria globosa* MILLETT, OMNH Reg. No. F10688F, $\times 160$
6a, b: *P. murrayi* (HERON-ALLEN & EARLAND), OMNH Reg. No. F10687F, $\times 140$
7a, b, c: *Pseudorotalia gaimardii* (D'ORBIGNY), OMNH Reg. No. F10691F, $\times 40$
8a, b: *Calcarina hispida* BRADY, OMNH Reg. No. F10636F, $\times 35$



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE XIII

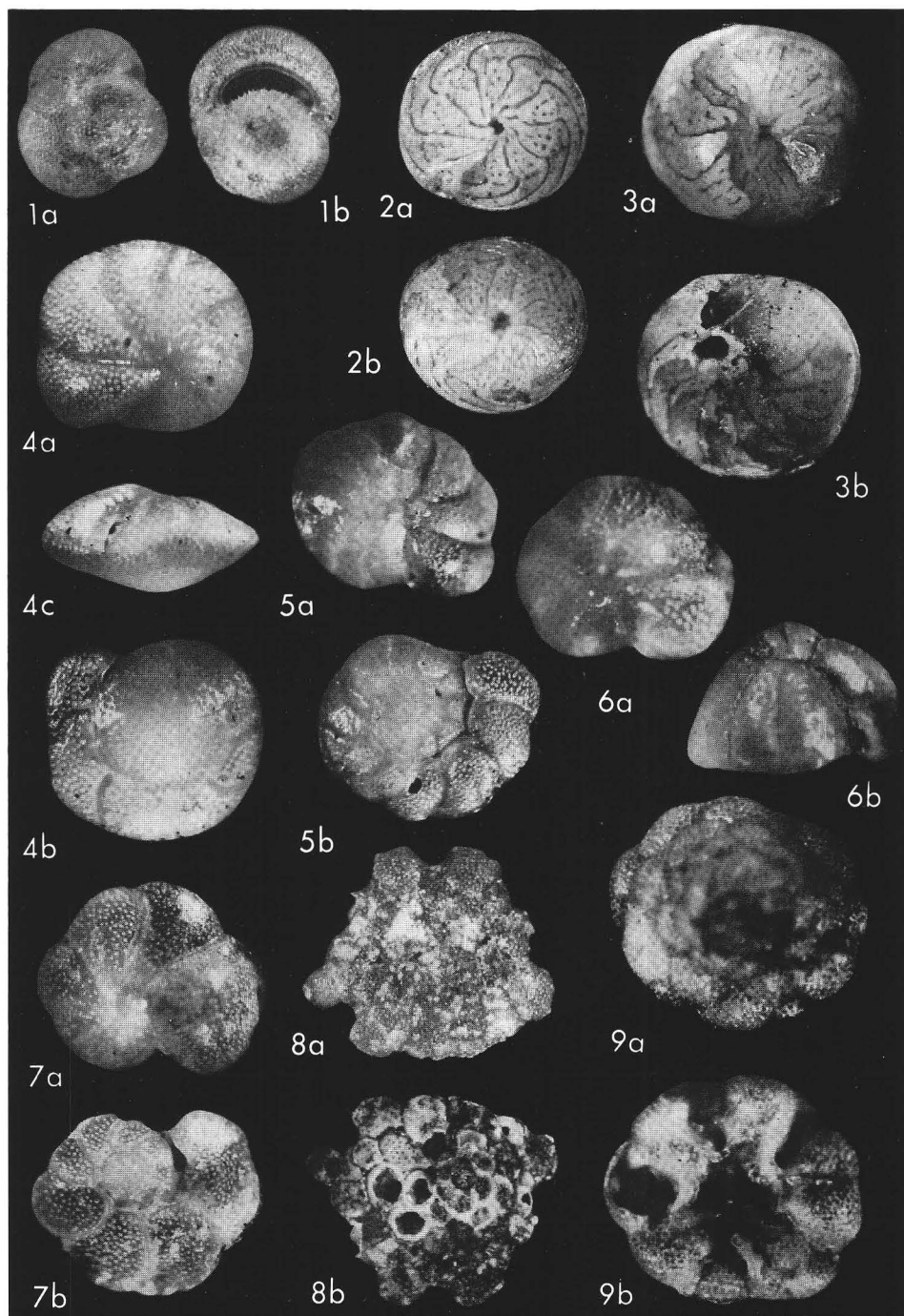
- 1: *Elphidium advena* (CUSHMAN), OMNH Reg. No. F10646F, ×80
- 2: *E. crispum* (LINNÉ), OMNH Reg. No. F10647F, ×50
- 3: *E. hispidulum* CUSHMAN, OMNH Reg. No. F10649F, ×80
- 4: *E. striatopunctatum* (FICHTEL & MOLL)?, OMNH Reg. No. F10650F, ×80
- 5: *E. jenseni* (CUSHMAN), OMNH Reg. No. F10651F, ×80
- 6: *E. matagordanum* (KORNFELD), OMNH Reg. No. F10652F, ×94
- 7: *E. incertum* (WILLIAMSON), OMNH Reg. No. F10653F, ×120
- 8: *E. translucens* NATLAND, OMNH Reg. No. F10654F, ×165
- 9: *Cellanthus craticulatum* (FICHTEL & MOLL), OMNH Reg. No. F10637F, ×50
- 10: *Operculina ammonoides* GRONOVIVS, OMNH Reg. No. F10685F, ×24
- 11a, b: *Hastigerina siphonifera* (D'ORBIGNY), OMNH Reg. No. F10748F, ×140
- 12a, b: *Globigerina quinqueloba* NATLAND, OMNH Reg. No. F10748F, ×120
- 13a, b: *Globorotaloides* cf. *variabilis* BOLLI, OMNH Reg. No. F10754F, ×80
- 14a, b: *Globigerina bulloides* D'ORBIGNY, OMNH Reg. No. F10749F, ×100
- 15a, b: *Globigerinoides triloba immatula* LEROY, OMNH Reg. No. F10752F, ×120
- 16: *G. triloba triloba* (REUSS), OMNH Reg. No. F10753F, ×60



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE XIV

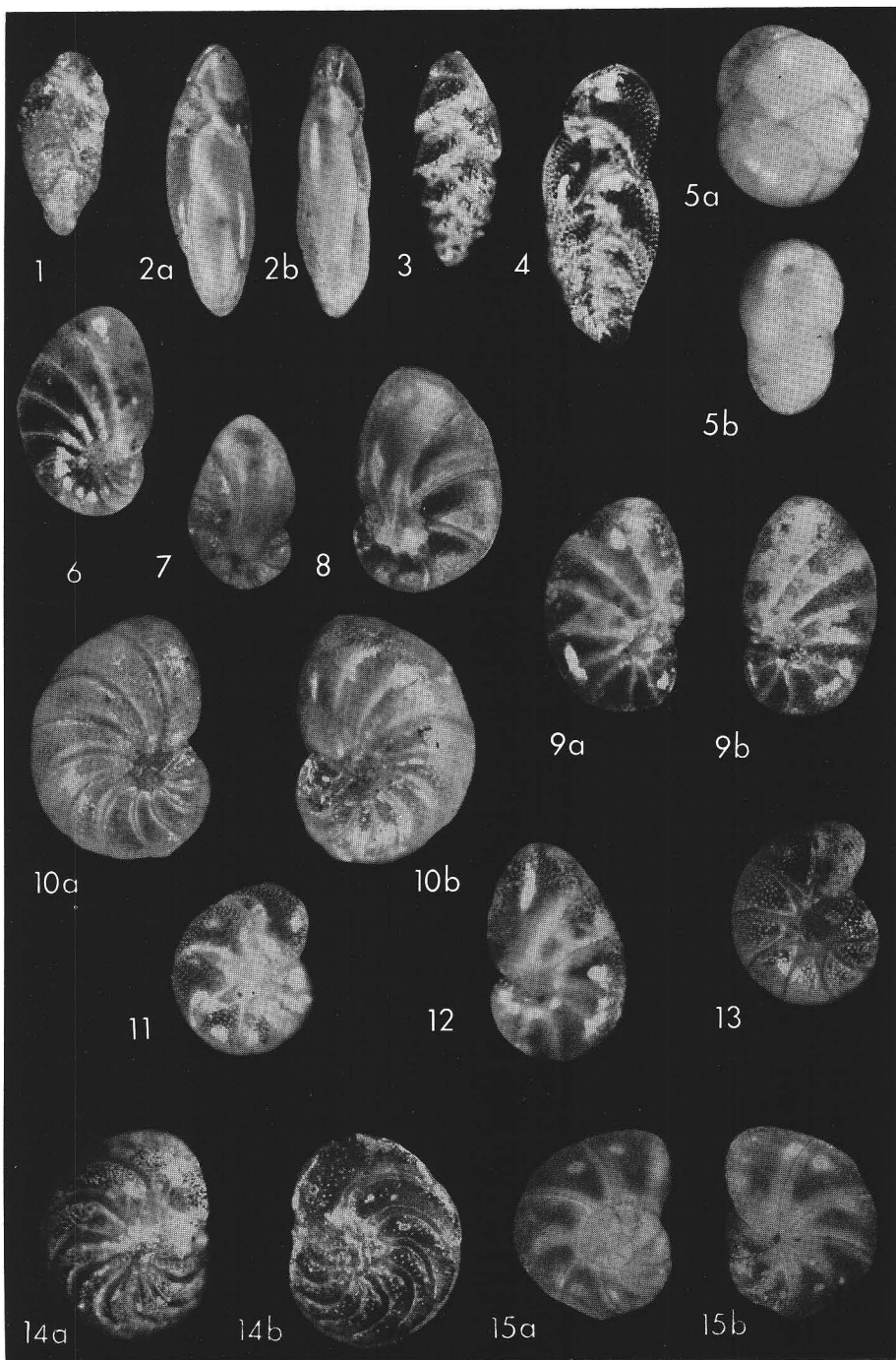
- 1a, b: *Pulleniatina obliqueloculata* (PARKER & JONES), OMNH Reg. No. F10755F, ×80
- 2a, b: *Amphistegina radiata* (FICHTEL & MOLL), OMNH Reg. No. F10623F, ×30
- 3a, b: *A. madagascariensis* D'ORBIGNY, OMNH Res. No. F10622F, ×30
- 4a, b, c: *Cibicides subhaidingerii* PARR, OMNH Reg. No. F10641F, ×53
- 5a, b: *C. pseudoungerianus* (CUSHMAN) OMNH Reg. No. F10639F, ×53
- 6a, b: *C. refulgens* MONTFORT, OMNH Reg. No. F10640F, ×80
- 7a, b: *C. lobatulus* (WALKER & JACOB), OMNH Reg. No. F10638F, ×53
- 8a, b: *Planorbulina* cf. *mediterraneensis* D'ORBIGNY, OMNH Reg. No. F10690F, ×53
- 9a, b: *Cymbaloporeta bradyi* (CUSHMAN), OMNH Reg. No. 10645F, ×60



M. CHIJI and S. M. LOPEZ: *Foraminiferal Assemblages in Tanabe Bay*

PLATE XV

- 1: *Sigmavirgulina tortuosa* BRADY, OMNH Reg. No. F10725F, $\times 80$
- 2a, b: *Fursenkoina pauciloculata* (BRADY), OMNH Reg. No. F10659F, $\times 80$
- 3: *Loxostomoides durrandii* (MILLETT), OMNH Reg. No. F10672F, $\times 105$
- 4: *L. limbatum* (BRADY), OMNH Reg. No. F10673F, $\times 105$
- 5a, b: *Globocassidulina subglobosa* (BRADY), OMNH Reg. No. F10667F, $\times 130$
- 6: *Nonion japonicum* ASANO, OMNH Reg. No. F10681F, $\times 80$
- 7: *Nonionella miocenica* CUSHMAN, OMNH Reg. No. F10682F, $\times 160$
- 8: *N. pulchella* HADA, OMNH Reg. No. F10683F, $\times 160$
- 9a, b: *Florilus grateloupi* (D'ORBIGNY), OMNH Reg. No. F10655F, $\times 132$
- 10a, b: *F. japonicus* (ASANO), OMNH Reg. No. F10656F, $\times 80$
- 11: *Astrononion stelligerum* (D'ORBIGNY), OMNH Reg. No. F10626F, $\times 132$
- 12: *Nonionellina labradrica* (DAWSON), OMNH Reg. No. F10684F, $\times 160$
- 13: *Melonis nikobarensis* (CUSHMAN), OMNH Reg. No. F10676F, $\times 120$
- 14a, b: *Hanzawaia nipponica* ASANO, OMNH Reg. No. F10668F, $\times 80$
- 15a, b: *Anomalina globulosa* CHAPMAN, OMNH Reg. No. F10624F, $\times 105$



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